A Revision of the Genus *Typhlodromus* Scheuten (Acari: Phytoseiidae)

by

H. A. Denmark

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ABSTRACT

The genus *Typhlodromus Scheuten* is here revised and keyed to species. Two new subgenera, *Trionus* and *Oudemanus* are herein described and 27 species are illustrated, including 3 new species: *Typhlodromus knisleyi, Typhlodromus quercicolus,* and *Typhlodromus zaheri.* The following new synonomies are proposed: *Typhlodromus perbibus* Wainstein and Arutunjan as a junior synonym of *Typhlodromus athiasae* Porath and Swirski; *Typhlodromus exhilaratus* Ragusa as a junior synonym of *Typhlodromus tiliae* Oudemans; and *Typhlodromus eucervix* Karg and Edland as a junior synonym of *Typhlodromus andrei* Karg. The plant hosts, food hosts, and distributions are discussed.

FOREWORD

Typhlodromus is worldwide in distribution and is found on fruit and forest trees, shrubs, and composites. Presently, 27 species are known in the genus. Some species are predators of spider mites and rust mites, although nothing is known about the biology and food habits for most species.

The author, Harold Anderson Denmark, was born 3 July 1921. He attended public schools in Winter Garden, Florida. In 1941 he joined the United States Navy and served 6 years, much of that time with the Submarine Service in the Pacific Theater of Operation, discharged as a Signalman First Class. He received his B.S.A. degree with honors from the University of Florida in 1952. The following year he received his M.S. degree from the same institution. During this period he served as an interim instructor in the Department of Entomology.

In July, 1953, he became an Entomologist with the State Plant Board of Florida (which, in 1961, became the Division of Plant Industry of the Florida Department of Agriculture). In July 1958 he became Chief Entomologist.

He is a member of Sigma Alpha Epsilon, Phi Kappa Phi, and Gamma Sigma Delta honor societies. He is also a member of the Florida Entomological Society (having served as president in 1970), Entomological Society of America, Acarology Society of America, Florida State Horticultural Society, International Organization for Biological Control of Noxious Animals and Plants, Southeastern Biological Control Working Group, and American Registry of Professional Entomologists.

Harold has been extensively recognized for his contributions to agriculture. In 1970, he was presented with the Florida Entomological Society's Appreciation Award for serving as president; in 1977, he received an Outstanding Service Award from the Florida Department of Agriculture and Consumer Services (FDACS); in 1982, he was given the Achievement Award in Research by the Florida Entomological Society; also in 1982, a Citation of Special Recognition was bestowed upon him for exceptional dedication and performance in the expansion and improvement of the Florida State Collection of Arthropods (FSCA) by FDACS; in 1988, he was awarded a Certificate of Appreciation for 35 years of meritorious service with FDACS; in 1990, he was honored as runner up for Best Single Communication for his circular on Lyme Disease Organisms in Florida from the State Safety Awareness Campaign; in 1991, he was credited with 2 awards, Gamma Sigma Delta's Distinguished Service to Agriculture; and from the U.S. Secretary of Agriculture, the "Honor Award for Group Achievement for Distinguished Service to the Protection of this Nation's Important Food and Fiber Resources through the Efficient and timely Eradication of the Mediterranean Fruit Fly."

He is author of 152 arthropod publications. His most recent work was is the revision of the 136 species of the genus *Amblyseius* worldwide, all completely described and illustrated, including 10 species new to science. This monumental work was the first in-depth study of this large genus, requiring 8 years to complete (partly due to the difficulty in borrowing type and other specimens from several foreign countries). His primary research interest is the biology, ecology, and taxonomy of Phytoseiidae. His research also includes Homoptera: Aphididae and Thysanoptera. He has served on graduate committees for students in Pakistan, India, and Egypt, as well as students at the University of Florida. He routinely identifies phytoseiids for workers from various countries. As a collaborator, he identifies all of the phytoseiids for the United States National Museum of Natural History, Smithsonian Institution, Washington, D.C. The FSCA, 5th largest terrestrial arthropod collection in the United States, includes one of the best phytoseiid collections in the New World, built through Mr. Denmark's efforts.

On 30 November 1947, Harold married Thelma L. Odom. They have 2 children: Jamie Lynn Palmer of Clarksville, Tennessee and Harold Anderson Denmark, Jr. of Gainesville, Florida. Harold is a Deacon in the First Baptist Church, in Gainesville, Florida. His hobbies include tennis, swimming, and gardening.

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INTRODUCTION

The genus *Typhlodromus* was proposed by Scheuten (1857) for his species *pyri.* Oudemans (1929), Westerborer and Bernhard (1963) accepted *Gamasus vepallidus* Koch, 1839 as the type species. Vitztheum (1941) proposed *Seiulus Berlese,* 1920 with *Gamasus vepallidus* as the type species. Garman (1948) proposed the name *Typhlodromus* with *Seiulus vepallidus* (Koch) as the type species. Nesbitt (1951), Evans (1957), Chant (1959), Muma (1961), Dosse (1961), Wainstein (1962), Hirschmann (1962), Karg (1971, 1982, 1983), Kolodochka (1974, 1978), Aruntunjan (1977), and Schicha (1987) accepted *Typhlodromus pyri* as the type species. Nesbitt (1951), Chant (1959), and Collyer (1964) considered *Typhlodromus tiliae* Oudemans to be a junior synonym of *pyri.* The original types of *T. pyri* are unavailable, however, Chant and Yoshida-Shaul (1987) did a world review of the *pyri* species group in which they designated a neotype of *pyri* taken in Germany. They deposited the neotype in the Canadian National Collection. It has been used to illustrate the species in this revision and is accepted by me. Evans (1988) redescribed *T. tiliae* and considered it to be a valid species, which is also accepted by me.

Some earlier workers placed most species of the family Phytoseiidae in *Typhlodromus.* I am restricting *Typhlodromus* to the *Typhlodromus* concept of Muma (1961). The genus *Typhlodromus* and subgenus *Typhlodromus* are revised and 2 new subgenera, *Oudemanus* Denmark new subgenus and *Trionus* Denmark new subgenus are described. All measurements are in microns. The new species, *Typhlodromus knisleyi, Typhlodromus quercicolus,* and *Typhlodromus zaheri* are deposited in the Florida State Collection of Arthropods (FSCA). Abbreviations for museums are United States National Museum of Natural History (U.S.NMNH); Canadian National Collection (CNC); Departmento de Zoologia, Escola Superior de Agricultura "Luis de Querioz" (ESCALQ), Universidade de Sao Paulo, Brazil; Biological and Chemical Research Institute, Rydalmere, Australia (BCRI).

Species that are either unknown, questionable, or not available for study which are not included in this study are: *Gamasus vepallidus* Koch and *Typhlodromus foliorum* Schrank.

GENUS *TYPHLODROMUS* SCHEUTEN

Typhlodromus Scheuten, 1857: 111; Oudemans, 1929: 14; 1930: 97; 1936: 261; Vitzthum, 1941: 767; Garman, 1948: 7; Nesbitt, 1951: 4; Cunliffe and Baker, 1953: 1; Womersly, 1954: 172; Muma, 1955: 268; 1961: 298; Chant, 1957: 289; 1957: 530; Athias-Henriot, 1957: 336; 1960: 67; Wainstein, 1958: 201; 1961: 156; 1962: 9; 1968: 1242; Herbert, 1958: 429; Ehara, 1959: 285; 1966: 19; Narayanan and Ghai, 1960: 392; Chant, 1957: 528-532; 1959: 1-166; 1960: 48; 1965: 351-374; Wainstein, 1961: 153; Dosse, 1961: 313; Pritchard and Baker, 1962: 218; Narayanan and Ghai, 1963: 539; Porath and Swirski, 1965: 90; El Badry, 1967: 183; 1968: 142; Abbasova, 1970: 45; Karg, 1971: 193, 221, 222; Schultz, 1973: 103; Chant, Hansell, and Yoshida-Shaul, 1974: 1265; Schicha and Dosse, 1975: 79; Kolodochka, 1974a: 26; Kolodochka, 1974b: 88; Ragusa, 1976: 113; Ragusa and Swirski, 1976: 190; Arutunjan, 1977: 46; Ragusa and Swirski, 1978: 211; Kolodochka, 1978: 56; Knisley and Denmark, 1978: 15 (misidentified); Abbasova, 1980: 832; Collyer, 1982: 187; Lehman, 1982: 234 (misidentified); Ueckermann and Loots, 1985: 5; Schicha, 1987: 120; Evans, 1988: 75; Chant and Yoshida-Shaul, 1987: 1770.

TYPE SPECIES - *Typhlodromus pyri* Scheuten, by subsequent designation of Oudemans (1929).

FEMALE - Small to moderate species. Dorsal scuta 273 to 392 long and 110 to 293 wide at L_5.

Dorsum - Verticals and clunals present; verticals moderate smooth, clunals tiny smooth. Chaetotaxy = 4, 2, 9, 2. Dorsal setae tiny smooth to very long serrate. Median setae M_1 tiny to moderate smooth, M_2 moderate to long smooth to very long serrate. Lateral setae moderate to long smooth to very long serrate. Sublateral setae on interscutal membrane and tiny to moderate smooth. Dorsal scutum weakly to heavily reticulated often with scattered muscle attachment apodemes, and usually with 3 to 4 medium to large pores and none to several scattered small pores (Fig. 1).

Venter - Chaetotaxy = 2-3 sternals (St), 3-4 preanals (PAS), 2-3 ventrolaterals (VL), and a pair of caudal setae (Cs). Sternal scuta slightly wider than long, smooth to lightly creased with truncate to trilobed posteriorly and 2-3 pairs of smooth moderate in length setae. Metasternal scuta (Ms) with a smooth to moderate length setae. Genital scutum smooth to lightly creased variable from narrower than to as wide as ventrianal scutum and 1 pair of smooth moderate length setae. Ventrianal scutum pentagonal to quadrate-shaped, about half the width of the body or less, and smooth to lightly creased, may or may not be provided with a pair of preanal pores, and 3-4 pairs of tiny to moderate smooth preanal setae. Three ventrolateral setae tiny to moderate smooth and arranged in 2 rows beside the ventrianal scutum. Metasternal scuta may or may not be present. Primary and secondary metapodal scuta (Mp) present and variable in size and form (Fig. 2). Peritremes normal, extending anteriorly to L_4 to nearly reaching the verticals; stigmatal scuta normal with 1 secondary pore variable in shape; peritremal scuta extend as an ectal strip around leg IV exopodal scuta (Fig. 3).

Spermathecae - Cervices saccular, fundibular, or saccular-fundibular with C-shaped, nodular, or undifferentiated atrium (Fig. 4).

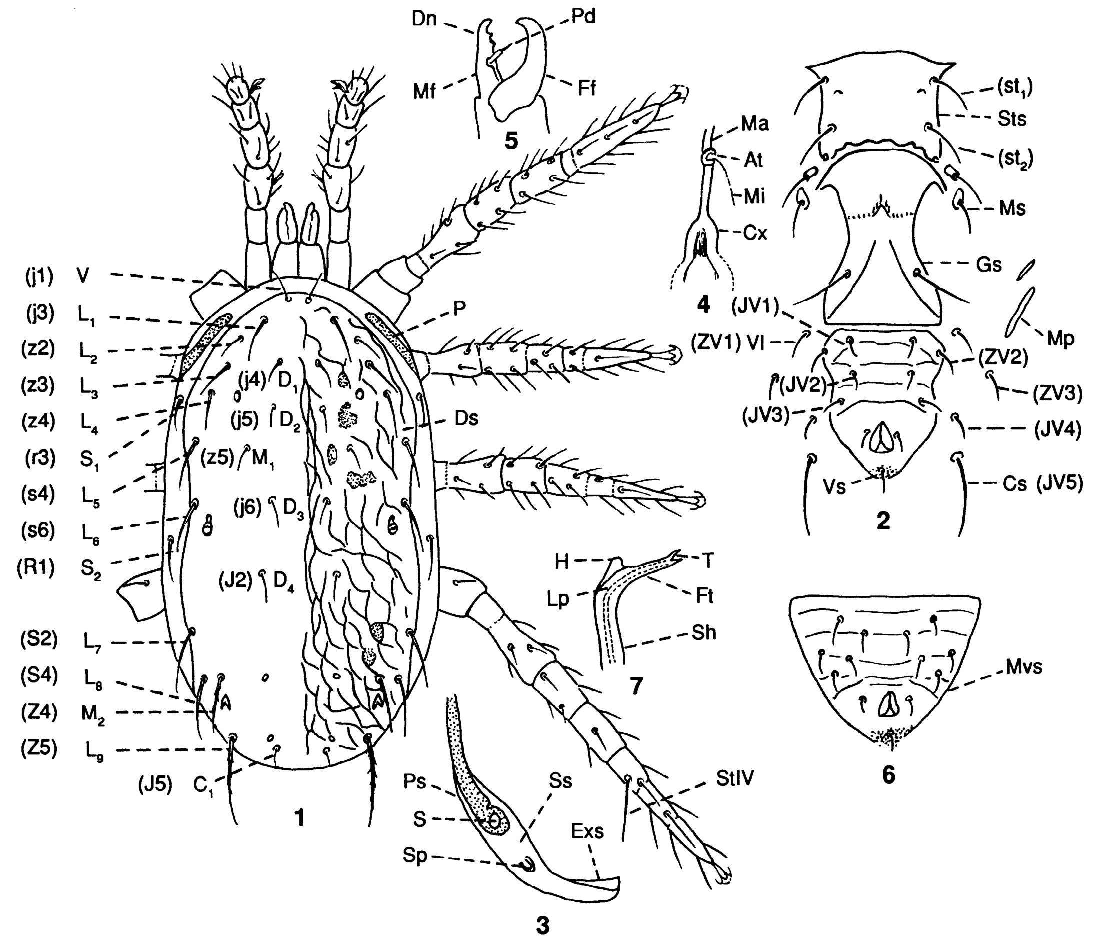
Chelicerae - Normal in size in relation to body size with dentition varying from 0 to 3 on movable finger and 2 to 6 and a pilus dentilis on fixed finger (Fig. 5).

Legs - Macrosetal chaetotaxy = 0, 0, 0, 0- 3. Genu II with 7 or 8 setae arranged 2-2-2/0-1, 2-2/1-2/0-1, or 1-2/1-2/0-1. Genu III with 7 setae arranged 1-2/1-2/0-1. Leg formula (longest leg in descending order) is 1423 or 4123.

MALE - Similar to female with smaller dorsal scuta and shorter setae. Ventrianal scuta shield-shaped with or without a pair of preanal pores and 4-5 pairs of tiny to moderate smooth setae (Fig. 6). Spermatodactyl with foot or heel terminal, indistinct heel, variable toe, usually with lateral process (Fig. 7). Macrosetae on legs shorter but similar in proportional size to those of female.

DISCUSSION - This genus is closely associated with *Metaseiulus* Muma and *Berethria* Muma and Tuttle. It differs from *Metaseiulus* by having 2 pairs of sublateral setae, spermatheca is pocular, saccular, fundibular, tubular-fundibular, or saccular-fundibular, ventrianal scuta more shield-shaped and has none or 1 pair of preanal pores, and 2 or 3 pairs of sternal setae whereas in *Metaseiulus* there is only 1 pair of sublateral setae, spermatheca is fundibular, ventrianal scuta is more constricted and without preanal pores, and only 2 pairs of sternal setae. *Typhlodromus* is also closely allied with *Berethria* but *Berethria* has only 2 pairs of ventrolateral setae; L_8 is associated with L_9, not M_2 as in *Typhlodromus*. Peritreme extends anteriorly to L_4 to nearly reaching verticals; peritremal scutum partially separated from stigmatal scutum by a weak suture.

Typhlodromus apparently is worldwide in distribution and is found on trees, shrubs, and composites. It is a relatively small genus of 27 species which are divided into three subgenera based on the number of



setae on the sternal scutum and ventrianal scutum and none or 3 macrosetae on leg IV.

The nomenclatural system used in this paper is the same as that used by Denmark and Muma (1989). Symbols in parenthesis are those of Rowell et al. (1978) to show comparison (Fig. 1-7).

Key to Subgenera of *Typhlodromus* Scheuten

1. Females with 2 pairs of sternal setae 2
Females with 3 pairs of sternal setae ....
.... *Trionus* Denmark n. sub. gen., p. 32
2. Females with 3 pairs of preanal ventrianal setae
.... *Oudemanus* Denmark n. subgen., p. 34
Females with 4 pairs of preanal ventrianal setae
.... *Typhlodromus* Scheuten, p. 5

TERMINOLOGY

SIZE - Small 200-300, moderate 301-400, large 401-500. Setal length: minute - less than half the width of genu IV; moderate -half to twice the width of genu IV; long - more than 2 to 4 times the width of genu IV; very long - more than 4 times the width of genu IV of the species in question.

ABBREVIATIONS - At-atrium, Cl-clunal setae, Cs-caudal setae, Cx-cervix, D_1-D_4-dorsal setae, Dn-denticule, Ds-dorsal scutum, Ect-exctal strip, Exs-leg IV exopodal scutum, Fd-fixed digit, Ft-foot, Ge-gential setae, Gs-genital scutum, H-heel, L_1-L_9-lateral setae, Lp-lateral process, M_1-M_2-median setae, Ma-major duct, Md-movable digit, Mi-minor duct, Mp-metapodal scutum, Ms-metasternal scutum, Mvs-male ventrianal scutum, P-peritreme, Pd-pilus dentilis, Pp-preanal pore, Ps-peritremal scutum, S_1-S_2-sublateral setae, S-stigmata, Sge IV-genual macroseta, Sh-shank, Sol-Solenostome, Sp-secondary pore, Ss-stigmatal scutum, St IV-tarsal macroseta, Sti IV-tibial macroseta, Sts-sternal scutum, T-toe, V-vertical seta, Vl-ventrolateral seta, Vs-ventrolateral scutum.

SPERMATHECAL TERMINOLOGY - Terminology concerning the spermathecae is that of Schuster and Smith (1960), modified from Dosse (1958), and utilized by Muma, Denmark, and De Leon (1970). The innermost structure of the spermatheca is the sack in which the male spermatophores are stored within the body of the female; it is seldom more than faintly, and even then evanescently, definable. The mesal end of the cervix opens into this spermatophore storage area; it is usually definable, but not in every female and frequently not on both sides of the same female. It lies between or just mesad of the coxae of legs III and IV of the adult female. At its ectal end, it is attached to the atrium, which opens into the major duct, through which the spermatophores are introduced into the female. In most, if not all species, the atrium also opens into the minor duct. The minor duct is not always definable within the same species and not definable at all on certain species. It is believed that the minor duct carries the sperm to fertilize the eggs as the female lays them, or after they are laid.

The structure and form of the spermathecal cervices and atria have been utilized by many workers in comparing and distinguishing species of phytoseiids. Muma, Denmark, and De Leon (1970) utilized a series of descriptive terms in describing the structures. The following definitions update and refine this terminology from 1970-1989.

CERVICES - Coniform (same in 1970), having a horn-like shape. Fundibular (fundibuliform in 1970), having a tapered or funnel-like shape.

Pocular (poculiform in 1970), shaped like a cup or bowl, either wider than long, as long as wide, or only slightly longer than wide.

Saccular (same in 1970), shaped like a sack, sack-like, longer than wide by a ratio of 1.5-4 times width. Tubular (same in 1970), shaped like a tube or pipe, tube-like, 4.5 times or more longer than wide.

Vesicular (same in 1970), partly swollen like a bladder, bladder-like.

Combinations of these terms are used sometimes when the cervix seems to be compound or complex; i.e. tubular-pocular means that the ectal portion is tube-like but the mesal portion is cup-like.

ATRIA - Undifferentiated (same in 1970), cannot be located at all. Differentiated (not used in 1970), can be located by thickened walls, darkened walls, granulation, or location of minor duct. Nodular (same in 1970), node or nut-like in shape.

Genus *Typhlodromus (Typhlodromus)* Scheuten

Typhlodromus Scheuten, 1857: 111; Oudemans, 1929: 14; Oudemans, 1930: 97; Vitzthum, 1941: 767; Womersley, 1954: 172; Chant, 1959: 64; Muma, 1961: 298; Wainstein, 1962: 920; El Badry, 1967: 183; 1967: 183; Abbasova, 1980: 832; Kolodochka, 1974: 88; 1978: 56; Chant, Hansell, and Yoshida-Shaul, 1974: 1274; Ragusa and Swirski, 1976: 190; Knisley and Denmark, 1978: 15; Lehman, 1982: 234; Schicha, 1987: 121; Chant and Yoshida-Shaul, 1987: 1782.

TYPE SPECIES - *Typhlodromus pyri* Scheuten, by subsequent designation of Oudemans, 1929. Females of this nominate subgenus always have 2 pairs of sternal setae, 4 pairs of preanal setae, 1 or 3 macrosetae on leg IV, and 3 or 4 large pores on dorsal scutum.

Key to the Species Groups in the Subgenus *Typhlodromus (Typhlodromus)* Scheuten

1. Cervix long fundibular-saccular to saccular with c-shaped atrium, M_2 equal to or longer than L_8, and 3-4 large pores on dorsal scutum .... *Pyri* Group, p. 6
2. Cervix long tubular-saccular or fundibular with c-shaped atrium, M_2 shorter than or equal to L_8, and 3-4 large pores on dorsal scutum .... *Cotoneastri* Group, p. 10
3. Cervix short to long saccular with c-shaped atrium, M_2 equal to or longer than L_8, and 3-4 pores on dorsal scutum .... *Tiliae* Group, p. 14
4. Cervix short saccular with c-shaped atrium, M_2 equal to or shorter than L_8, and 4 large pores on dorsal scutum .... *Atticus* Group, p. 20
5. Cervix long saccular with c-shaped atrium, M_2 longer than L_8, and 4 large pores on dorsal scutum .... *Athiasae* Group, p. 21
6. Cervix long saccular with c-shaped atrium, M_2 longer or shorter than L_8, and 3-4 pores on dorsal scutum .... *Ulex* Group, p. 24
7. Cervix short tubular-fundibular with nodular atrium; saccular cervix with c-shaped atrium; or tubular-fundibular cervix with undifferentiated atrium, and 3-4 large pores on dorsal scutum .... Unassigned Group, p. 28

Species Groups of *Typhlodromus (Typhlodromus)* Scheuten

PYRI GROUP

T. pyri Scheuten
T. americanus Chant and Yoshida-Shaul
T. knisleyi Denmark n. sp.

COTONEASTRI GROUP

T. cotoneastri Wainstein
T. andrei Karg
T. tubifer Wainstein

TILIAE GROUP

T. tiliae Oudemans
T. quercicolus Denmark n. sp.
T. corticis Herbert

T. setubali Dosse
T. zaheri Denmark n. sp.

ATTICUS GROUP

T. atticus Swirski and Ragusa
T. ernesti Ragusa and Swirski

ATHIASAE GROUP

T. athiasae Porth and Swirski
T. pritchardi Arutunjan

ULEX GROUP

T. ulex Evans
T. phialatus Athias-Henriot
T. klimenkoi Kolodochka
T. laurae Arutunjan

UNASSIGNED GROUP

T. swirskii Denmark
T. moroccoensis Denmark
T. baccettii Lombardini

PYRI GROUP

Three species are assigned to this group. They are *T. pyri* Scheuten, *T. americanus* Chant and Yoshida-Shaul, and *T. knisleyi* Denmark n. sp. *T. pyri* is recognized in having a saccular spermatheca with a short neck and small c-shaped atrium. *T. americanus* has a saccular spermatheca, no to very short neck, and c-shaped atrium. *T. knisleyi* has a saccular spermatheca and nodular c-shaped atrium.

Key to Females in *Pyri* Group

1. Leg IV with 3 macrosetae and movable digit of chelicera with 2 denticules .... *knisleyi* Denmark n. sp., p. 9
   Leg IV with 1 macroseta and movable digit of chelicera with 1 denticule 2
2. Spermatheca tubular saccular with c-shaped atrium and 3 large pores on the dorsum .... *pyri* Scheuten, p. 6
   Spermatheca saccular with nodular-c-shaped atrium and 4 pores on dorsum .... *americanus* Chant and Yoshida-Shaul, p. 8

Typhlodromus pyri Scheuten
Fig. 8-14

Typhlodromus pyri Scheuten, 1857: 104; Oudemans, 1929: 14; Oudemans, 1930: 99; Vitzthum, 1941: 764; Nesbitt, 1951: 5; Muma, 1961: 298; Dosse, 1961: 313; Swirski and Amitai, 1961: 193; Wainstein, 1962: 20; Carmona, 1962: 14; Schuster and Pritchard, 1963: 213; Westerboer and Bernhard, 1963: 583; Boczek and Kropczynska, 1964: 162; Kropczynska and Jener, 1967: 322; El Badry, 1967: 183; Zack, 1969: 79; Rasmy and MacPhee, 1970: 173; Abbasova, 1970: 45; Karg, 1971: 193; Wainstein, 1973: 176; Schultz, 1973: 103; Chant et al., 1974: 1265; Kolodochka, 1974a: 26; Kolodochka, 1974b: 88; Schicha and Dosse, 1975: 79; Ragusa and Swirski, 1976: 190; Ragusa, 1976: 113; Swirski and Ragusa, 1977: 79; Arutunjan, 1977: 46; Kolodochka, 1978: 56; Ragusa and Swirski, 1978: 211; Knisley and Denmark, 1978: 15; Abbasova, 1980: 832; Kolodochka, 1981: 18, Beglyarov, 1981: 28; Lehman, 1982: 234; Collyer, 1982: 187; Ueckermann and Loots, 1985: 5; Chant and Yoshida-Shaul, 1987: 1782.

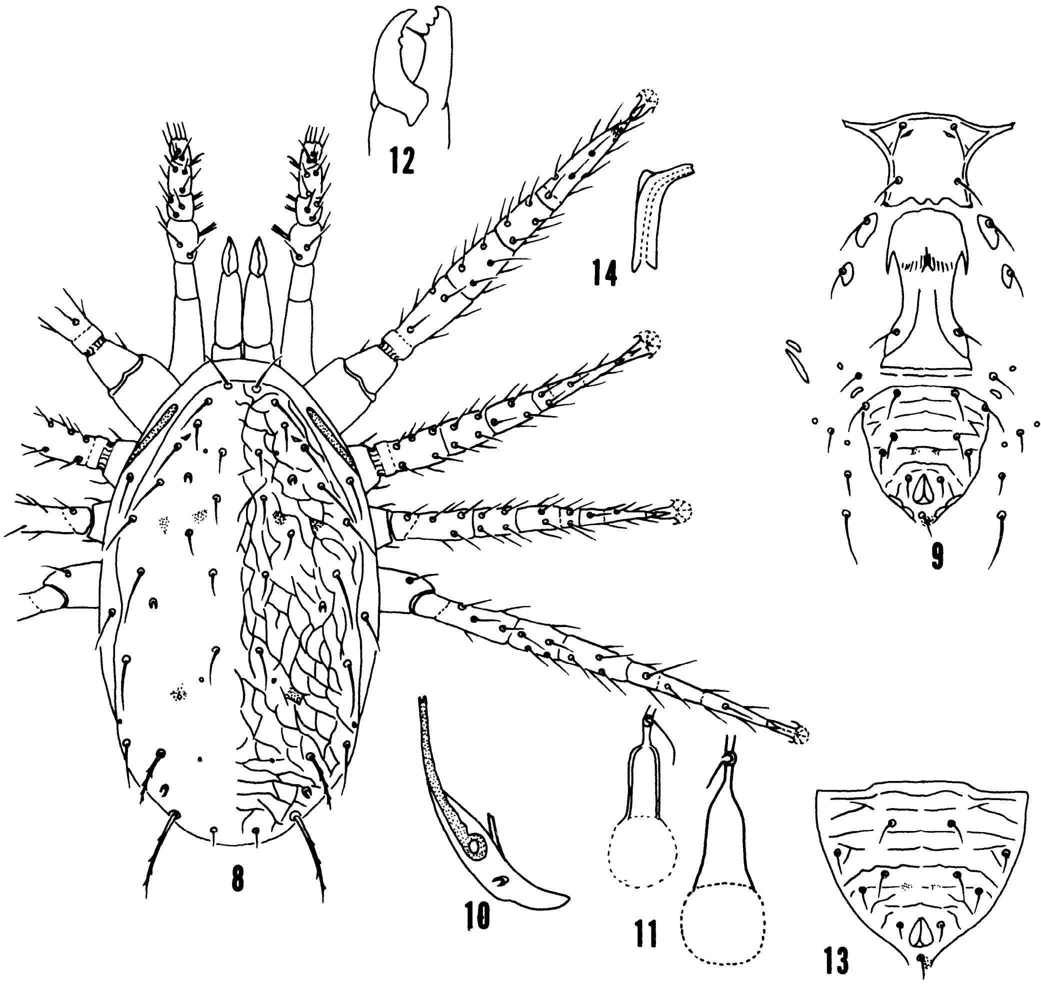
TYPE - Female neotype, Germany: Bonn, 12 II 1985, R.I.C. Hansell, on pear tree in (CNC), designated by Chant and Yoshida-Shaul (1987).

DIAGNOSIS - *Typhlodromus pyri* Scheuten is similar to *T. americanus* Chant and Yoshida-Shaul and *T. knisleyi* Denmark n. sp. but differs in having 3 large pores on the dorsal scutum, 2 denticules on the movable digit, M_2 serrate and equal in length to M_2 in *americanus*, and spermatheca with short neck and small c-shaped atrium, as apposed to 4 large pores in *americanus* and *knisleyi*, M_2 smooth and shorter than in *pyri* and *americanus*, and spermatheca saccular with no or very short neck and c-shaped atrium in both *americanus* and *knisleyi*. *T. knisleyi* has M_2 smooth and equal to or shorter than L_8 as apposed to *T. americanus* with M_2 serrate and longer than L_8.

FEMALE - Length 317-330; width at L_5 165-169. Dorsal scutum reticulated with 3 large pores and 17 pairs of setae. Measurements of setae: verticals 16-24; D_1 19, D_2 19, D_3 19, D_4 27; clunals 5; L_1 27-31, L_2 20-23, L_3 22-28, L_4 26-28, L_5 27-31, L_6 33-58, L_7 36-44, L_8 38-42, L_9 58-63; M_1 17-19, M_2 42-47; anterior sublaterals 25-27; posterior sublaterals 22-24. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum creased with 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to or beyond L_2. Chelicerae normal in relation to body size, fixed digit with 2 denticules and movable digit with 2 denticules. Leg formula 4123. Macroseta St IV 17. Genu II 2-2/1-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with short tubular neck, long saccular cervix 17-23, and c-shaped atrium.

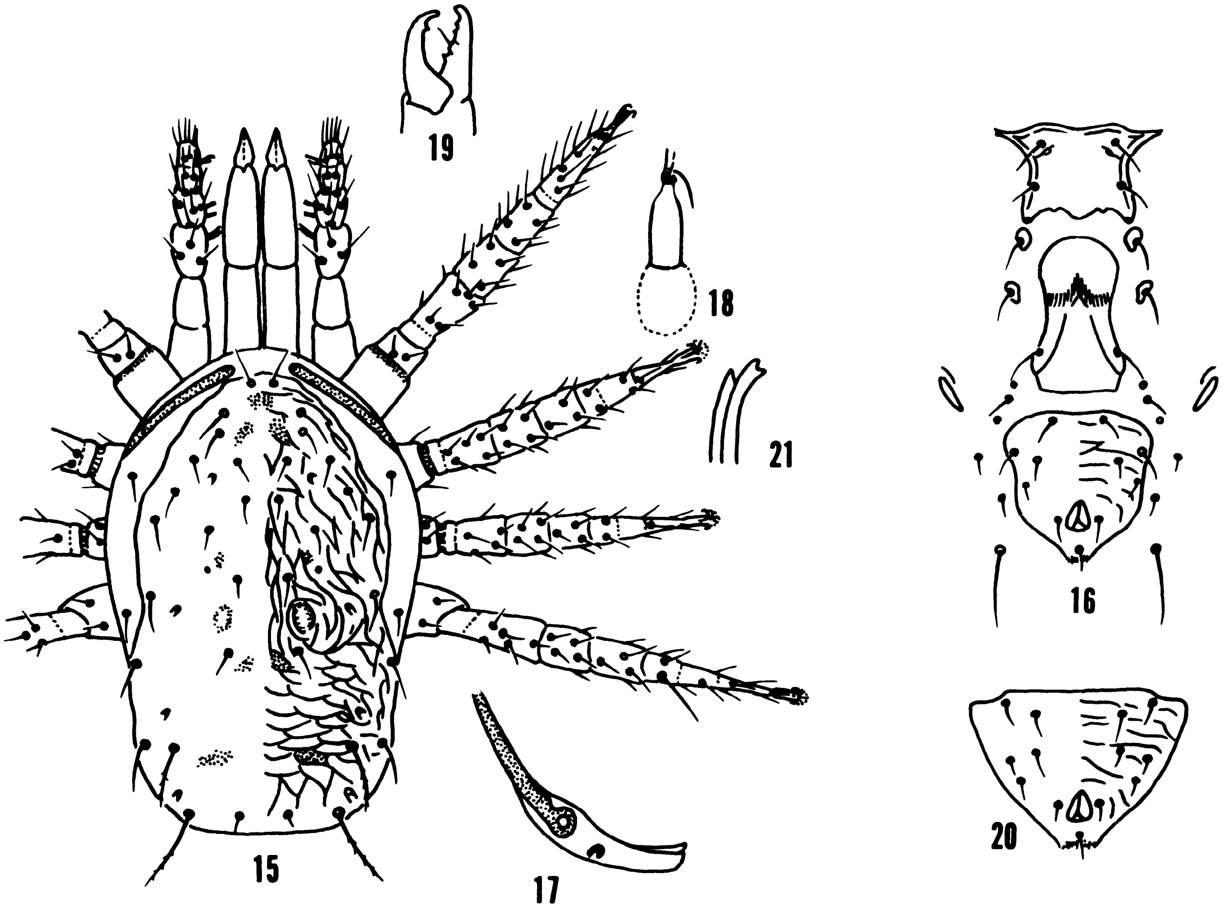
MALE - The male is similar to the female but smaller in size. The spermatodactyl has foot terminal, lateral process not evident and toe not enlarged. The ventrianal scutum creased and 4 pairs of preanal setae.

DISCUSSION - This species has been reported in the literature from Germany, Belgium, Czechoslovakia, Denmark, England, Holland, Hungary, Norway, Sweden, U.S.S.R. - (Azerbaidzhan; Ukraine; Moldavia; Great



Figs. 8-14. *Typhlodromus pyri* Scheuten. 8. Dorsal and leg structure and setation (female). 9. Ventrianal scuta and setation (female). 10. Posterior peritremal and stigmatal development (female). 11. Spermathecal structure (two variations) (female). 12. Cheliceral structure (female). 13. Ventrianal scutum (male). 14. Spermatodactyl structure (male).

Caucasus Region), Armenia, Greece, Egypt, and Portugal. I have specimens from Italy and Switzerland. In the U.S.A. it has been reported in Washington, Oregon, California, Pennsylvania, New York, and New Jersey. I have specimens from Oregon and California. Specimens reported from Pennsylvania (Lehman, 1982) and New Jersey (Knisley and Denmark, 1978) are *T. americanus*. It has been reported from Canada in Nova Scotia. I have slides from Nova Scotia on apple. *T. pyri* appears to prefer trees, but is also found on shrubs, vines, and weeds. The literature records the following hosts: *Aesculus hippocastanum, Pyrus communis, Malus* spp., *Prunus* spp., *Tilia platyphyllo, Acer* sp., *Quercus* sp., English holly, mountin ash, hazelnut, spruce, dogwood, arbovitae, Douglas fir, false cypress, fir, hemlock, peach, filbert, *Taxus* sp., *Adanthus glandulosa, Adenophora* sp., *Amaranthus* sp., raspberry, blackberry, plum, cherry, ivy, many shrubs, and moss. This species has been collected in association with *Tetranychus* sp. and *Bryobia redikorzevi* (Kolodochka, 1978), *Panonychus ulmi* Koch (Collyer, 1953), *Brevipalpus* sp., and a tarsonemid mite (Paparoannoy-Sogliotis, 1981), *Phyllocoptes vitis* Nalepa (Mathys, 1957), *Bryobia arborea* Morgan and Anderson (Herbert, 1962). Chant (1959) investigated *T. pyri* life cycle and feeding habits and concluded it was not an effective predator of *Panonychus ulmi* Koch or *Vasates schlechtendali* (Nalepa). Zaher and Shahata (1971) found *pyri* prevalent in Lower Egypt inhabiting several plants. It was more common on a wide range of fruit trees and reproduced on *Tetranychus cinnaberinus* (Boisduval) and pollen grains. They found that only mated females layed eggs and copulated several times. Females consumed an average of 1006 eggs, 729 larvae and nymphs, or 509 adult mites. Most of the consumption occurred in the adult stage. Females overwintered in aggregations on buds, branches, and leaves that remained green. Mating occurred immediately after the last molt. Other studies of the biology, predation, and pesticide



Figs. 15-21. *Typhlodromus americanus* Chant and Yoshida-Shaul. 15. Dorsal and leg structure and setation (female). 16. Ventrianal scuta and setation (female). 17. Posterior peritremal and stigmatal development (female). 18. Spermathecal structure (female). 19. Cheliceral structure (female). 20. Ventrianal scutum (male). 14. Spermatodactyl structure (male).

resistance are Collyer (1964), Hoyt (1972), Wearing et al. (1978), Collyer (1980), Overmeer and Van Zon (1981), and Overmeer et al. (1982). Wysaki and Bolland (1983) studied the karyotype of *T. pyri* in England. Zacharda (1989) gives a seasonal history and phenology of an indigenous field population inhabiting a commercial apple orchard in South Bohemia.

Typhlodromus americanus
Chant and Yoshida-Shaul
stat. nov.
Fig. 15-21

Typhlodromus pyri Scheuten; Knisley and Denmark, 1978: 15 (misidentification).

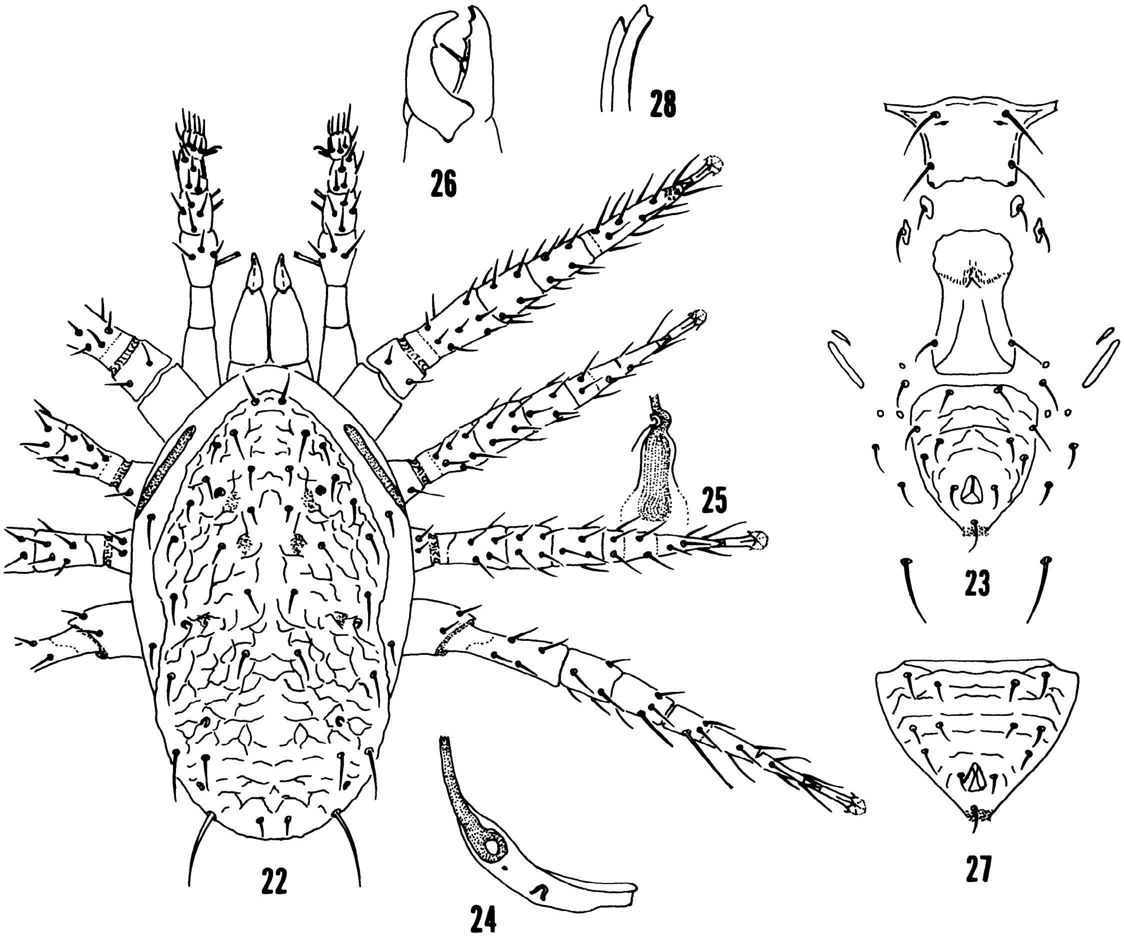
Typhlodromus exhilaratus americanus Chant and Yoshida-Shaul, 1989: 1796.

TYPE - Female holotype, U.S.A.: Oregon: Cottage Grove, 7 VII 1975, R.I.C. Hansell, on pine in (CNC No. 19312).

DIAGNOSIS - See *Typhlodromus pyri* Scheuten.

FEMALE - Length 330-347; width at L_5 176-178. Dorsal scutum reticulated with 4 large pores and 17 pairs of setae. Measurements of setae: verticals 24-25; D_1 15-16, D_2 16, D_3 17, D_4 19; clunals 4-5; L_1 25-27, L_2 17, L_3 19, L_4 19, L_5 25, L_6 28, L_7 30-33, L_8 35-40, L_9 61-67; M_1 16-17, M_2 43-47; anterior sublaterals 27-28; posterior sublaterals 23-24. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum lightly creased with 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to verticals. Chelicerae normal in relation to body size, fixed digit with 3 denticules, movable digit with 1 denticule. Leg formula 4123. Macroseta Sti IV 40-43. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with saccular cervix 17 and c-shaped atrium.

MALE - Similar to females but smaller. Ventrianal scutum lightly creased with 4 pairs of preanal setae. Spermatodactyl with foot terminal and short heel.



Figs. 22-28. *Typhlodromus knisleyi* Denmark n. sp. 22. Dorsal and leg structure and setation (female). 23. Ventrianal scuta and setation (female). 24. Posterior peritremal and stigmatal development (female). 25. Spermathecal structure (female). 26. Cheliceral structure (female). 27. Ventrianal scutum (male). 28. Spermatodactyl structure (male).

DISCUSSION - Six female paratypes were collected with the holotype and additional specimens have been collected in New Jersey, Washington D.C., Maryland, and North Carolina on mock orange, arborvitae, juniper, boxwood, and *Pinus* sp. Knisley and Denmark (1978) found *Typhlodromips sessor* (De Leon) and *Amblydromella nodosus* (De Leon) associated with the specimens in New Jersey they incorrectly identified as *Typhlodromus pyri* Scheuten. Nothing is known about the biology or food habits of *T. americanus*. This description is based on the holotype specimen of *Typhlodromus exhilaratus americanus* Chant and Yoshida-Shaul.

Typhlodromus knisleyi Denmark n. sp.

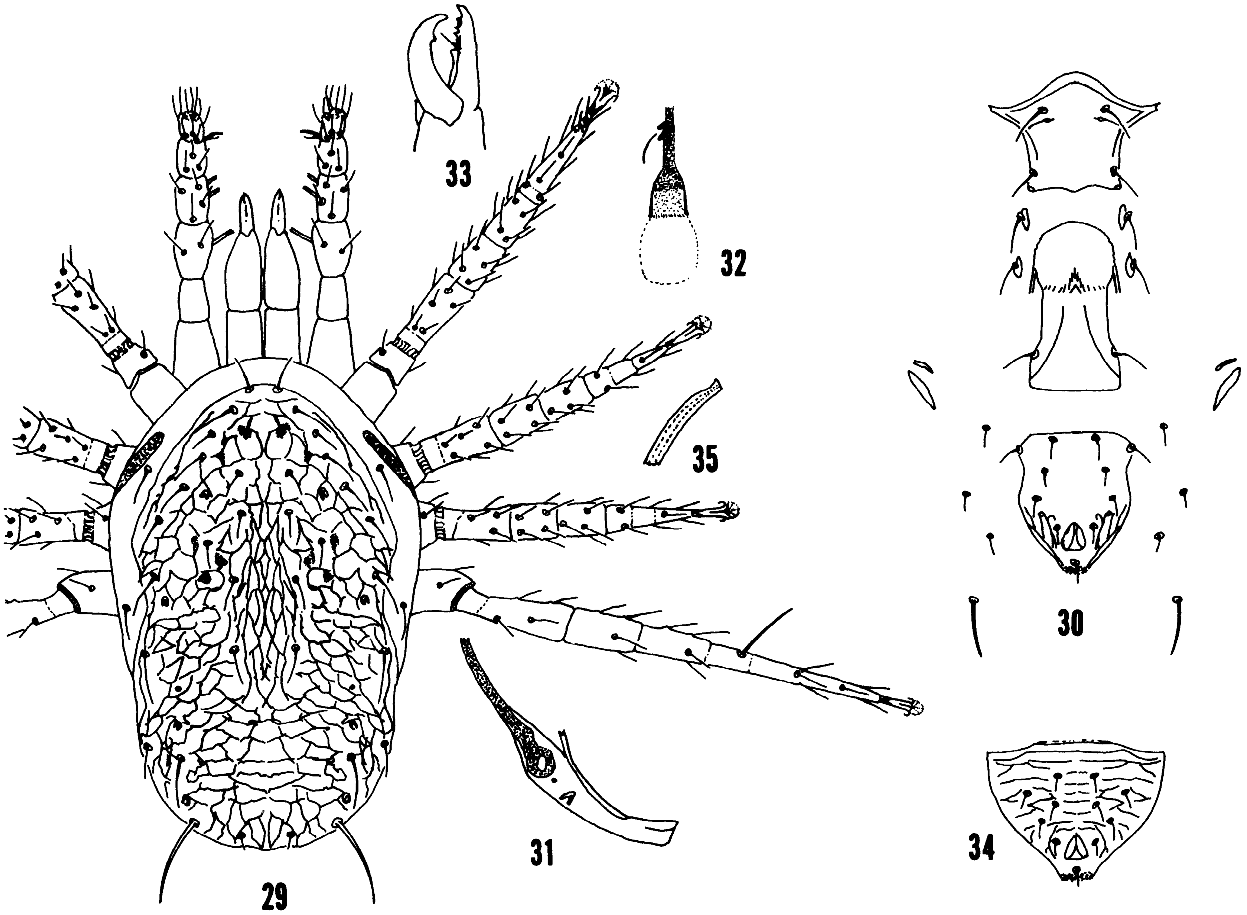
Fig. 22-28

Typhlodromus pyri Scheuten, Knisley and Denmark, 1978: 15 (misidentification).

TYPE - Female Holotype, U.S.A.: New Jersey: St. Forest, 21 VIII 1972, C.B. Knisley on *Tsuga canadensis*, in (FSCA).

DIAGNOSIS - See *Typhlodromus pyri* Scheuten.

FEMALE - Length 318; width at L_5 164. Dorsal scutum reticulated with 4 large pores and 17 pairs of setae. Measurements of setae: verticals 24; D_1 16, D_2 14, D_3 17, D_4 17; clunals 5; L_1 27, L_2 17, L_3 19, L_4 20, L_5 24, L_6 24, L_7 25, L_8 32, L_9 58; M_1 16, M_2 28; anterior sublaterals 21; posterior sublaterals 22. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum lightly creased with 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly between L_1 and L_2. Chelicerae normal in relation to body size, fixed digit with 2 denticules, movable digit with 1 denticule. Leg formula 4123. Macrosetae Sge IV 23, Sti IV 33, St IV 54. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with saccular cervix 16 and c-shaped atrium.



Figs. 29-35. *Typhlodromus cotoneastri* Wainstein. 29. Dorsal and leg structure and setation (female). 30. Ventrianal scuta and setation (female). 31. Posterior peritremal and stigmatal development (female). 32. Spermathecal structure (female). 33. Cheliceral structure (female). 34. Ventrianal scuta (male). 35. Spermatodactyl structure (male).

MALE - Similar to female but smaller. Ventrianal scutum lightly creased with 5 pairs of preanal setae. Spermatodactyl with foot terminal.

DISCUSSION - One female paratype was collected with the holotype. This species is known only from St. Forest, New Jersey. Knisley and Denmark (1978) misidentified this species as *Typhlodromus pyri* Scheuten. Nothing is known of the biology or food habits. This description is based on the holotype specimen.

COTONEASTRI GROUP

Three species are assigned to this group. They are *T. cotoneastri* Wainstein, *T. andrei* Karg, and *T. tubifer* Wainstein. All species have tubular-saccular spermathecae with a c-shaped atrium. *T. cotoneastri* and *T. andrei* have 4 large pores on the dorsum, but *tubifer* has only 3 large pores on the dorsum. *T. andrei* has a pore on the ventrianal scutum and 3 pairs of macrosetae on leg IV while *cotoneastri* and *tubifer* have no pores on the ventrianal scutum and 1 macroseta on leg IV.

Key to Females in *Cotoneastri* Group

1. Ventrianal scutum with small round pair of pores, leg IV with 3 macrosetae .. *andrei* Karg, p. 11
   Ventrianal scutum without pores and leg IV with 1 macroseta 2
2. Dorsal scutum with 4 pairs of large pores and movable digit of chelicera with 1 denticule (male ventrianal scutum with 4 pairs of preanal setae) .... *cotoneastri* Wainstein, p. 11
   Dorsal scutum with 3 pairs of large pores and movable digit of chelicera with 2 denticules (male ventrianal scutum with 5 pairs of preanal setae) .... *tubifer* Wainstein, p. 12

Typhlodromus cotoneastri Wainstein
Fig. 29-35

Typhlodromus cotoneastri Wainstein, 1961: 156; Hirschmann, 1962: 14; 1973: Ehara, 1966: 58; Arutunjan, 1969: 46; 1970: 18; Abbasova, 1970: 46; Arutunjan, 1971: 43; Livshitz and Kuznetsov, 1972: 16; Hirschmann, 1973: 176; Kolodochka, 1974: 214; Ragusa and Swirski, 1976: 190; Kolodochka, 1978: 54; Abbasova, 1980: 830; Swirski and Amitai, 1982: 58; Chant and Yoshida-Shaul, 1987: 1788.

TYPE - Female holotype, U.S.S.R.: Kodzhori, Georgia, 19 VII 1955, B.A. Wainstein, on *Cotoneaster integerrima*, in Institute of Zoology, Academy of Science of the Ukrainian S.S.R., Kiev.

DIAGNOSIS - *Typhlodromus cotoneastri* Wainstein is similar to *Typhlodromus andrei* Karg and *Typhlodromus tubifer* Wainstein but differs in having the following combinations of characters: 1 macroseta on leg IV, no pores on the ventrianal scutum, 1 denticule on the movable digit of the chelicerae, peritreme extending anteriorly to L_2, 4 pairs of preanal setae on the male ventrianal scutum, and short tubular-saccular spermatheca; as apposed to the following set of characters in andrei: 3 macrosetae on leg IV, a pair of small round pores on the ventrianal scutum, 2 denticules on the movable digit of the chelicerae, peritreme extending anteriorly to L_4, 5 pairs of preanal setae on the male ventrianal scutum, and short tubular-saccular spermatheca; and the following set of characters in *tubifer:* 1 macroseta on leg IV, no pores on the ventrianal scutum, 2 denticules on the movable digit of the chelicerae, peritreme extending anteriorly to L_2, long tubular-pocular spermatheca, and 5 pairs of preanal setae on the male ventrianal scutum.

FEMALE - Length 336; width at L_5 165. Dorsal scutum reticulated with 4 large pores, 2-3 small pores, scattered muscle marks, and 17 pairs of setae. Measurements of setae: verticals 24; D_1 17, D_2 17, D_3 19, D_4 22; clunals 4-9; L_1 29, L_2 17, L_3 25, L_4 27, L_5 31, L_6 31, L_7 33, L_8 28, L_9 58; M_1 17, M_2 37; anterior sublaterals 27; posterior sublaterals 26. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum smooth with 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to the level of L_2. Chelicerae normal in relation to body size, fixed digit with 4 denticules, and movable digit with 1 denticule. Leg formula 4123. Macroseta St IV 47. Genu II 2-2/2/0-1; genu III 1-2/1-2/0-1. Spermatheca tubular flared cervix 17 with c-shaped atrium.

MALE - Similar to female but smaller in size, spermatodactyl with foot terminal, lateral process not evident, and toe normal in size. Ventrianal scutum creased with 4 pairs of preanal setae.

DISCUSSION - In addition to the type specimens, specimens have been taken on *Acer* sp. and *Fagus* sp. in Italy (Ragusa and Swirski, 1976: 190); on *Malus* sp. in Turkey (Swirski and Amitai, 1982: 58); U.S.S.R.-Armenia: *Cerasus* sp., *Elaeagnus* sp., *Juglans regia, Malus* sp., *Morus* sp., *Populus tremula, Prunus armeniaca, Prunus avium, Prunus cerasifera, Prunus* sp., *Quercus* sp., forest tree (Arutunjan, 1969b: 46, 1970: 18, 1971b: 43); Azerbaijan: *Acer* sp., *Carpinus* sp., *Cerasus* sp., *Cornus* sp., *Crataegus* sp., herb, *Mespilus* sp., *Morus* sp., *Prunus armeniaca, P. cerasifera, Prunus* sp., *Pyrus* sp., *Quercus* sp., *Rosa* sp., *Rubus* sp., *Solanum tuberosum* (Abbasova, 1970a: 46, 1972, 1980: 830); Bol'Shom Kavkaz: *Acer* sp., *Carpinus* sp., *Cerasus* sp., *Crataegus* sp., *Mespilus* sp. *Prunus cerasifera, Pyrus* sp., *Quercus* sp., *Rosa* sp., *Rubus* sp., *Solanum tuberosum* (Abbasova, 1966: 185); Crimea: *Cryptomeria japonica, Cupressus* sp., *arborvitae, Lonicera* sp., *Pinus halepensis, Punica granatum, Sequoia gigantea* (Livshitz and Kuznetsov, 1972: 16); Georgia: *Malus* sp., *Picea* sp., *Pinus* sp., *P. avium, Quercus* sp. (Samsoniya, 1972: 194), (Wainstein, 1961: 156); Moldavia: *Cotinus* sp., *Prunus spinosa, Quercus pubescens, Vitis* sp. (Wainstein, 1973a: 126); Ukraine: *Caragana* sp., *Carpinus* sp., *Corylus* sp., *Crataegus* sp., *Juglans regia, Juniperus rufescens, J. sabina, Morus* sp., *Physocarpus* sp., *Picea* sp., *Pinus* sp., *Prunus armeniaca, Pyrus* sp., *Quercus* sp., *Ulmus foliacea, U. laevis* (Kolodochka, 1974b: 26, 1978: 54). It has been reported associated with the twospotted spider mite, *Tetranychus urticae* Koch and Eriophyidae. This description is based on the holotype specimen.

Typhlodromus andrei Karg
Fig. 36-42

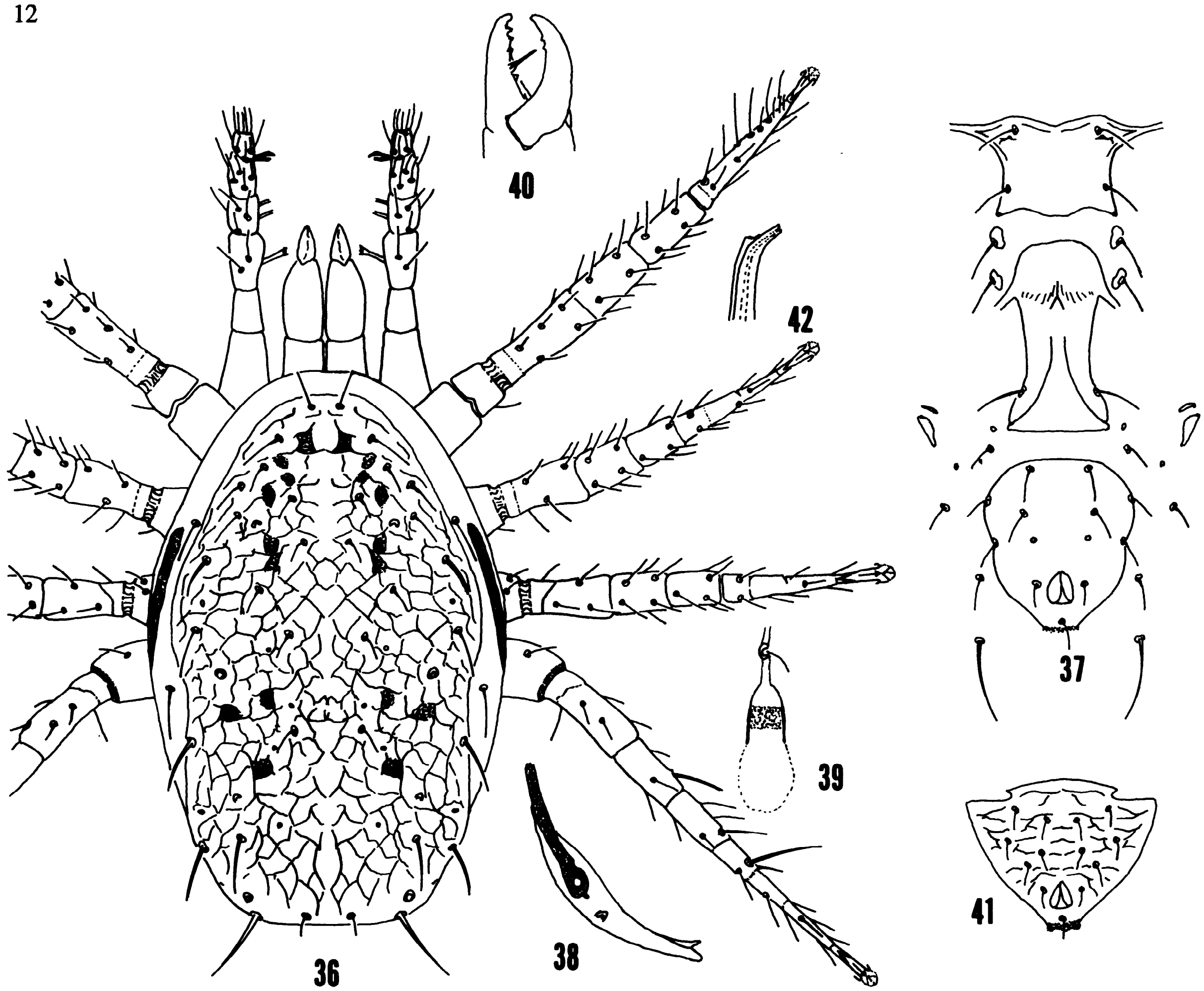
Typhlodromus andrei Karg, 1982: 206; Moraes et al., 1986: 241.

Typhlodromus eucervix Karg and Edland, 1987: 392, (TYPE: Norway, Nr. Asker, Brunlanes, 22 V 1984, *T. Edland*, on *Juniperus communis*, in Norwegian Plant Protection Institute, Department of Entomology and Nematology), new synonym.

TYPE - Female holotype, Belgium: Louvain - La Neuve, 1977, Andre, on bark of fruit tree, in Institute for Plant Protection Research, Kleinmachnow, East Germany.

DIAGNOSIS - See *Typhlodromus cotoneastri* Wainstein.

FEMALE - Length 380-385; width at L_5 200. Dorsal scutum reticulated with 4 large pores, scattered muscle marks, and 17 pairs of setae. Measurements of setae: verticals 22-27; D_1 18, D_2 18, D_3 20-21, D_4 20-21; clunals 6; L_1 32-35, L_2 17-18, L_3 27, L_4 21, L_5 27-30, L_6 32, L_7 33-35, L_8 35-38, L_9 45-52; M_1 19, M_2 35-36;



Figs. 36-42. *Typhlodromus andrei* Karg. 36. Dorsal and leg structure and setation (female). 37. Ventrianal scuta and setation (female). 38. Posterior peritremal and stigmatal development (female). 39. Spermathecal structure (female). 40. Cheliceral structure (female). 41. Ventrianal scuta (male). 42. Spermatodactyl structure (male).

anterior sublaterals 31; posterior sublaterals 33. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum smooth with a pair of small round pores, 4 pairs of preanal setae, and 3 pairs of ventrolateral setae. Chelicerae normal in relation to body size, fixed digit with 4 denticules, and movable digit with 2 denticules. Peritreme extending anteriorly to the level of L_4. Leg formula 4123. Macrosetae Sge IV 25, Sti IV 26, St IV 50. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca tubular-saccular cervix 19-22 and c-shaped atrium.

MALE - Similar to female but smaller. Ventrianal scutum reticulated with 5 pairs of preanal setae. The spermatodactyl with foot terminal, toe normal, and lateral process not visible.

DISCUSSION - In addition to the type specimens the specimens collected by Dr. T. Edland near Asker, Norway, 22 V 1984 on *Juniperus communis* and described by Karg and Edland as *T. andrei*. There are slight variations in setal lengths. Nothing is known about the biology of this species. This description is based on the holotype specimen.

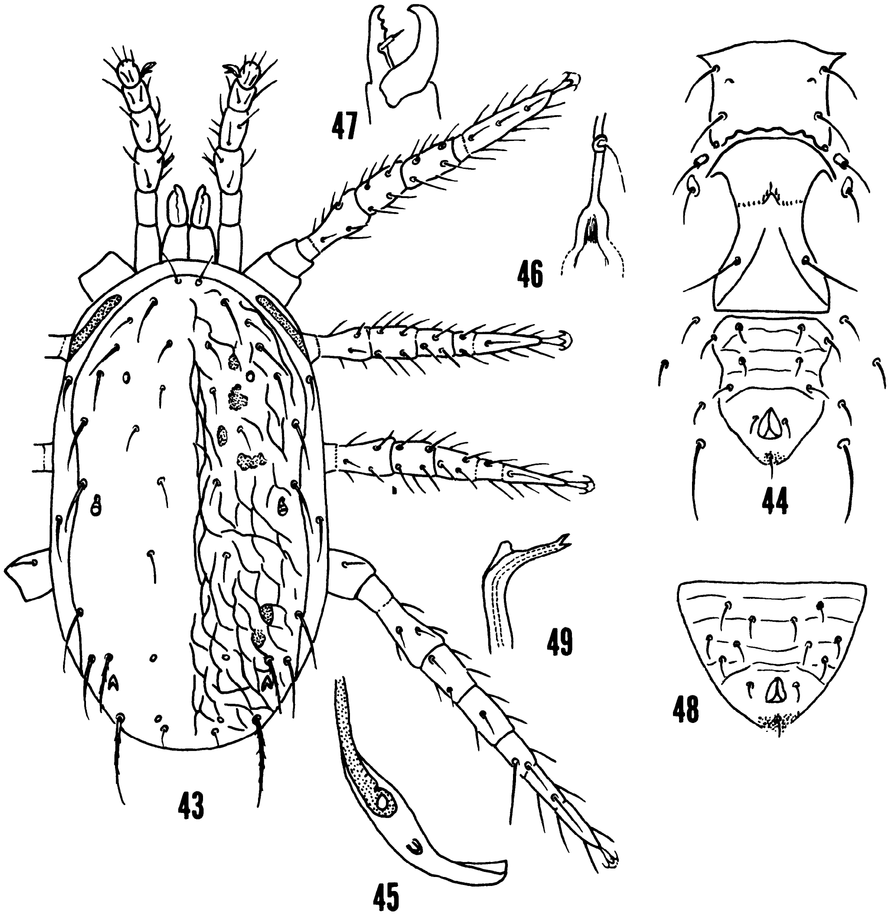
Typhlodromus tubifer Wainstein
Fig. 43-49

Typhlodromus tubifer Wainstein, 1961: 157; Hirschmann, 1962: 14; Ehara, 1966: 19; Arutunjan, 1977: 46; Abbasova, 1980: 832; Daneshvar and Denmark, 1982: 6; Moraes et al., 1986: 248.

TYPE - Female holotype, U.S.S.R.: Manglisi, Georgia S.S.R., 7 VIII 1961, G.F. Reck, on *Quercus* sp., in Institute of Zoology, Academy of Science of the Ukrainian S.S.R., (Kiev).

DIAGNOSIS - See *Typhlodromus cotoneastri* Wainstein.

FEMALE - Length 282-365; width at L_5 141-250. Dorsal scutum entirely reticulated with 3 large pores, scattered muscle marks anteriorly, and 17 pairs of setae.



Figs. 43-49. *Typhlodromus tubifer* Wainstein. 43. Dorsal and leg structure and setation (female). 44. Ventrianal scuta and setation (female). 45. Posterior peritremal and stigmatal development (female). 46. Spermathecal structure (female). 47. Cheliceral structure (female). 48. Ventrianal scuta (male). 49. Spermatodactyl structure (male).

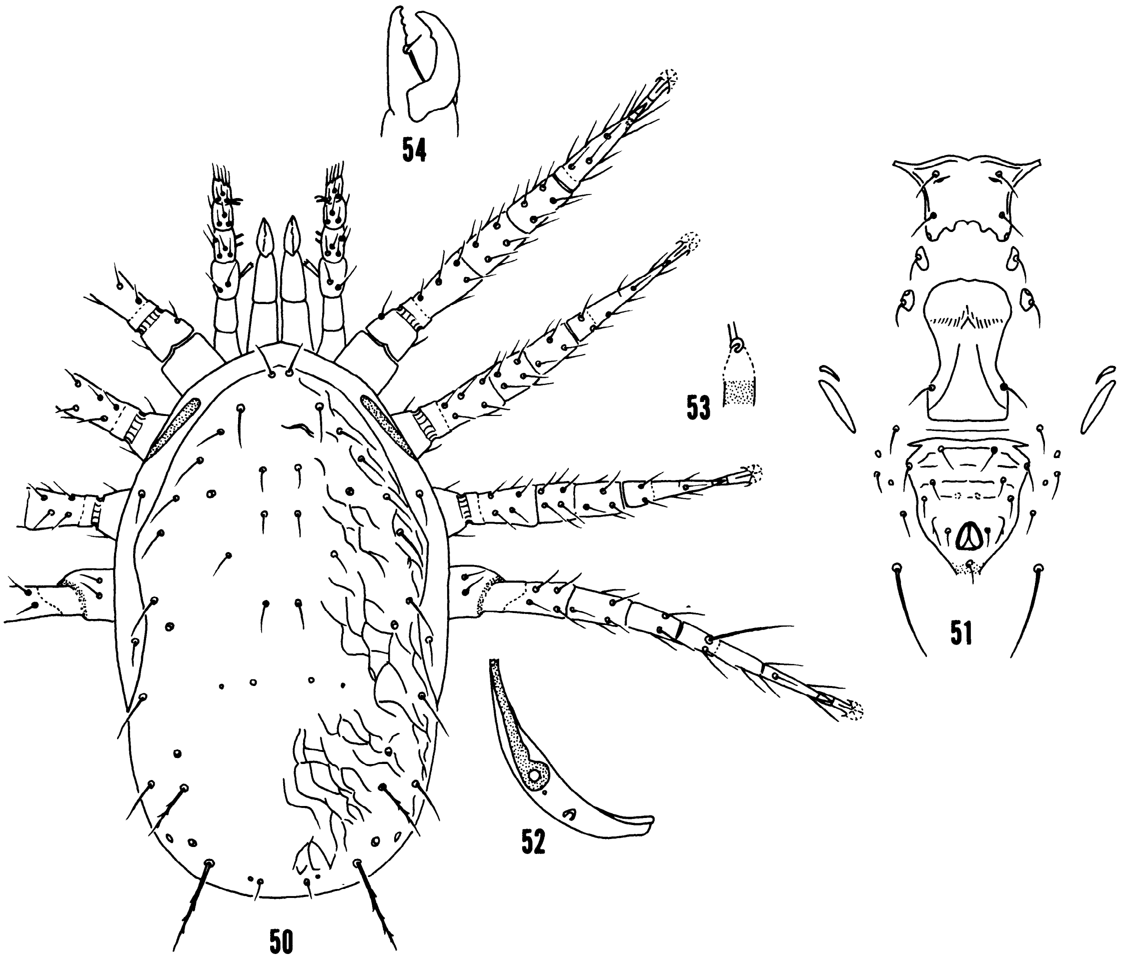
Measurements of setae: verticals 19-22; D_1 14-18, D_2 15-17, D_3 16-20, D_4 19-20; clunals 4; L_1 22-26, L_2 18-20, L_3 22-27, L_4 26, L_5 27-31, L_6 29-33, L_7 29-34, L_8 28-36, L_9 47-58; M_1 19, M_2 27-33; anterior sublaterals 27-29; posterior sublateral 19-22. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum smooth with 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly between L_2 and L_3. Chelicerae normal in relation to body size, fixed digit with 2 denticules, and movable digit with 2 denticules. Leg formula 4123. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with tubular-pocular cervix 19-20 and c-shaped atrium.

MALE - Similar to female but smaller. The ventrianal scutum creased with 5 pairs of preanal setae. The spermatodactyl with foot terminal, toe not enlarged and lateral process observed in some specimens.

DISCUSSION - This species has been collected in Georgia and Azerbaidzhan in U.S.S.R. and in Iran. It has been taken on the following host plants: Cherry plum, sweet cherry, filbert, hornbean, ironwood, oak, quince, red currant, and a herbaceous plant. Abbasova (1980) reported that this species seems to prefer "forest type" plants and often is associated with oak. She also described a species she had earlier identified as *tubifer* as *T. ajsel* new species. Chant and Yoshida-Shaul (1987) made *ajsel* a junior synonym of *tubifer*. Nothing is known about the biology and food habits of this species. This description is based on the holotype specimen.

TILIAE GROUP

Five species are assigned to this species group. They are *T. tiliae* Oudemans, *T. quercicolus* Denmark n. sp., *T. corticis* Herbert, *T. setubali* Dosse, and *T. zaheri* Denmark n. sp. *T. tiliae* and *T. corticis* have short saccular spermathecal cervices with c-shaped atria. *T. setubali*, *T. quercicolus*, and *T. zaheri* have long saccular spermathecal cervices with c-shaped atria. All



Figs. 50-54. *Typhlodromus tiliae* Oudemans. 50. Dorsal and leg structure and setation (female). 51. Ventrianal scuta and setation (female). 52. Posterior peritremal and stigmatal development (female). 53. Spermathecal structure (female). 54. Cheliceral structure (female).

species have 4 large pores on the dorsal scutum. These species can be separated by the length of the dorsal setae, pores or lack of pores on ventrianal scutum, and number of leg IV setae.

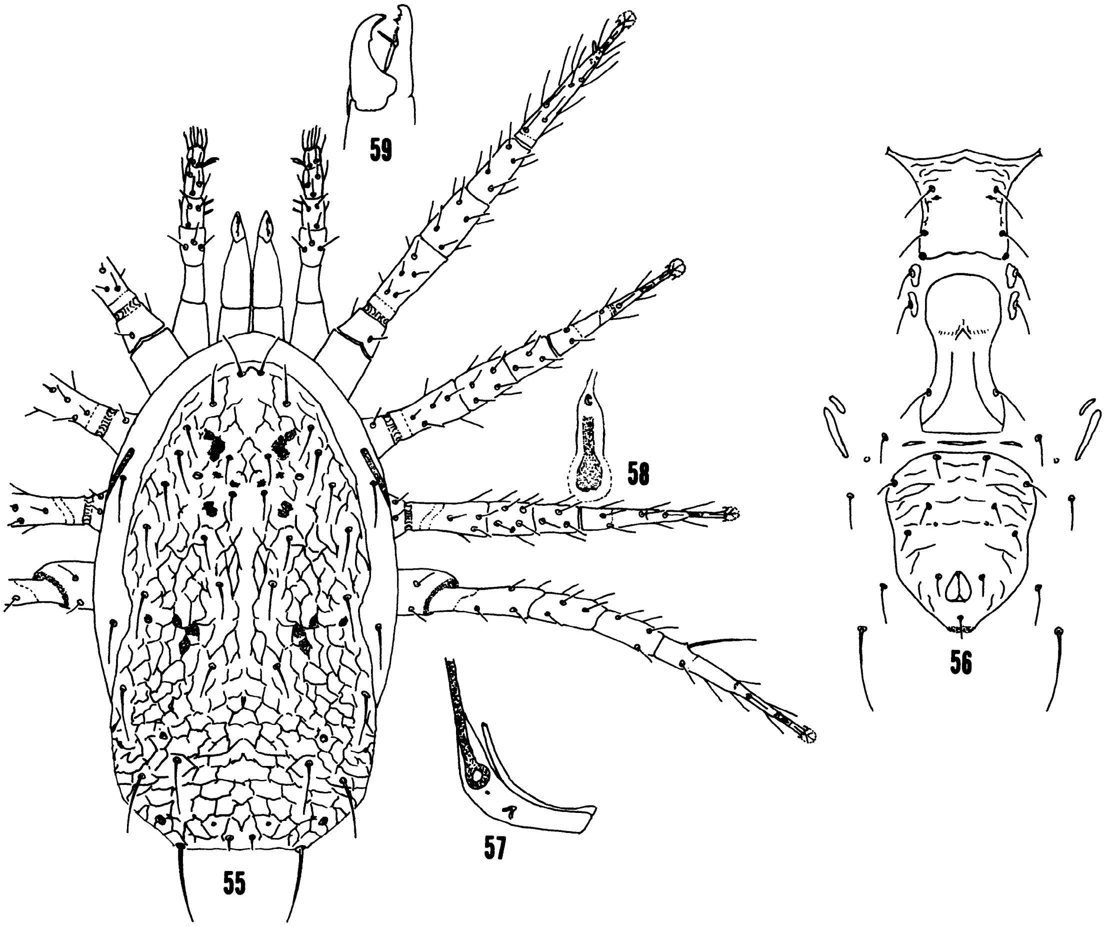
Key to Females in *Tiliae* Group

1. Leg IV with 3 macrosetae 2
   Leg IV with 1 macroseta.....................................4
2. Ventrianal scutum with a pair of pores .... *corticis* Herbert, p. 17
   Ventrianal scutum without pores 3
3. Dorsal scutum reticulated entirely, L_5 38, L_6 45, L_8 46, and spermathecal cervix approximately 8 wide ....*zaheri* Denmark n. sp., p. 19
   Dorsal scutum reticulated posteriorly, L_5 29, L_6 28, L_8 35, and spermathecal cervix approximately 15 wide .... *setubali* Dosse, p. 18
4. L_9 and M_2 smooth, L_8 50, and Sti IV 64 .... *quercicolus* Denmark n. sp., p. 16
   L_9 and M_2 serrate, L_8 39, and Sti IV 38 .... *tiliae* Oudemans, p. 14

Typhlodromus tiliae Oudemans
Fig. 50-54

Typhlodromus tiliae Oudemans, 1929: 51-52; Nesbitt, 1951: 31; Chant, 1955: 500-501; Chant, 1956: 206; Collyer, 1956: 208; Chant, 1958: 622; Dosse, 1958: 7; Hirschmann, 1962: 12; Wainstein, 1962: 23; Begljarov, 1962: 198-199; Abbasova, 1970: 45-47; Livshitz and Kuznetsov, 1972: 21; Chant et al., 1974: 1268-1270; Swirski and Ragusa, 1976: 116; Paparoannoy-Soyliotis, 1981: 40; Evans, 1988: 76-78.

Typhlodromus exhilaratus Ragusa, 1977: 380-383, (TYPE: Instituto di Entomologia Agraria Universita Degli Studi di Palermo, Palermo, Italy), new synonym.



Figs. 55-59. *Typhlodromus quercicolus* Denmark n. sp. 55. Dorsal and leg structure and setation (female). 56. Ventrianal scuta and setation (female). 57. Posterior peritremal and stigmatal development (female). 58. Spermathecal structure (female). 59. Cheliceral structure (female).

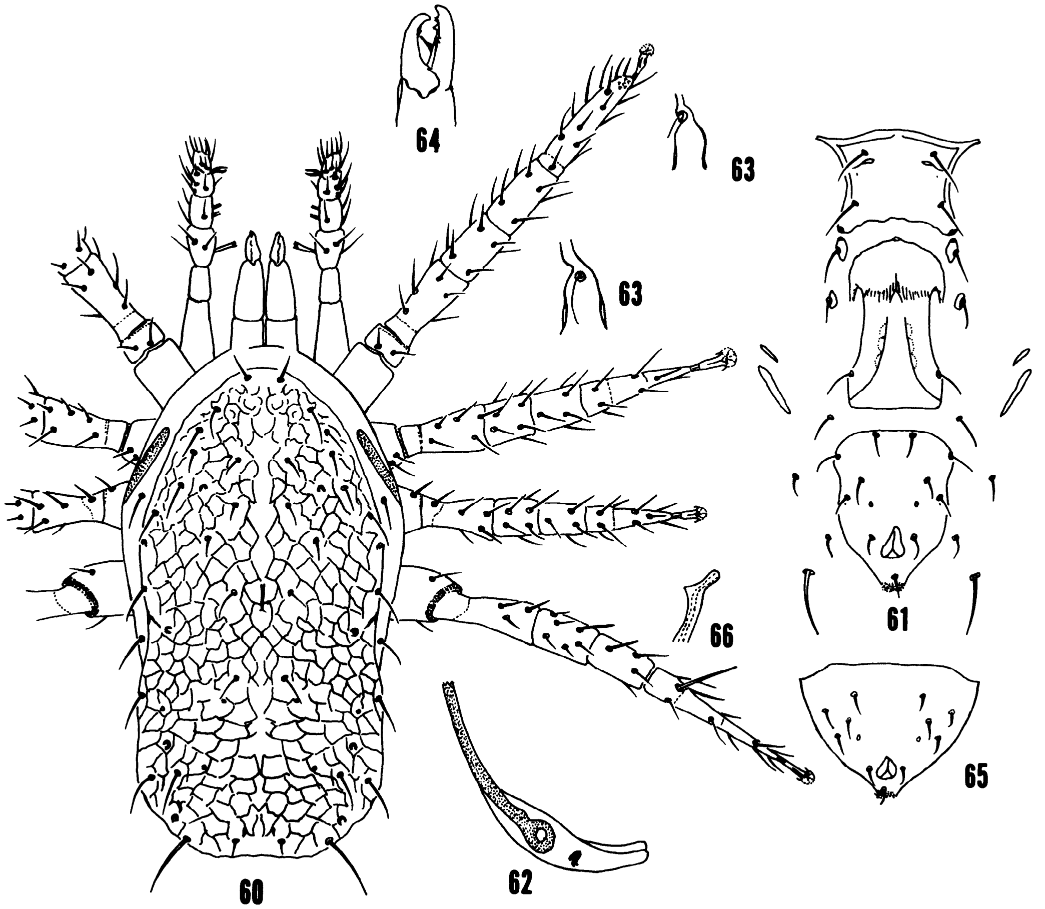
TYPE - Female holotype, Germany: Dahlem, Berlin, 26 IV 1926, F. Zacher, on *Pinus sylvestris*, in Rykamuseum van Natuurlyke Histoire, Leiden, the Netherlands.

DIAGNOSIS - *Typhlodromus tiliae* Oudemans is similar to *Typhlodromus quercicolus* Denmark n. sp. but differs in having M_2 and L_9 serrate, peritreme extending anteriorly to L_1, and St IV 38 as apposed to M_2 and L_9 smooth, peritreme extending anteriorly to L_2, and St IV 64 in *quercicolus*.

FEMALE - Length 345; width at L_5 188. Dorsal scutum creased to reticulated, particularly laterally and posteriorly, 4 large pores, and 17 pairs of setae. Measurements of setae: verticals 25; D_1 17, D_2 20, D_3 17, D_4 broken; clunals 5; L_1 29, L_2 20, L_3 27, L_4 25, L_5 28, L_6 35, L_7 39, L_8 39, L_9 72; M_1 17, M_2 41; anterior sublaterals 27; posterior sublaterals 25. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum lightly creased with 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to L_1. Chelicerae normal in relation to body size, fixed digit with 3 denticules, and movable digit with 1 denticule. Leg formula 4123. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with short saccular cervix 11 and c-shaped atrium.

MALE - Unknown.

DISCUSSION - *Typhlodromus tiliae* was considered to be a junior synonym of *Typhlodromus pyri* by some earlier workers. Abbasova (1970), Chant and Yoshida-Shaul (1987), and Evans (1987) are in agreement that *tiliae* is a valid species and can be separated from *pyri*. Chant and Yoshida-Shaul (1987) recorded the literature records referring to *tiliae*. As they indicated, these records may be questionable until the species have been confirmed for these records. *Typhlodromus exhilaratus* is considered a synonym here based on a paratype of *exhilaratus* and a specimen examined from Egypt compared with the type of *tiliae*. *Typhlodromus tiliae*



Figs. 60-66. *Typhlodromus corticis* Herbert. 60. Dorsal and leg structure and setation (female). 61. Ventrianal scuta and setation (female). 62. Posterior peritremal and stigmatal development (female). 63. Spermathecal structure (female). 64. Cheliceral structure (female). 65. Ventrianal scuta (male). 66. Spermatodactyl structure (male).

appears to have variable length dorsal setae. It also has only 7 setae on Genu II as does *exhilaratus*. The blunt macroseta St IV appears on both specimens. A third specimen from Egypt has these same characters, but with slightly different length dorsal setae. Nothing is known about the life history and food habits. The literature reports association with several species of spider mites. This description is based on the holotype specimen.

Typhlodromus quercicolus Denmark n. sp.
Fig. 55-59

Typhlodromus quercicolus Denmark n. sp.

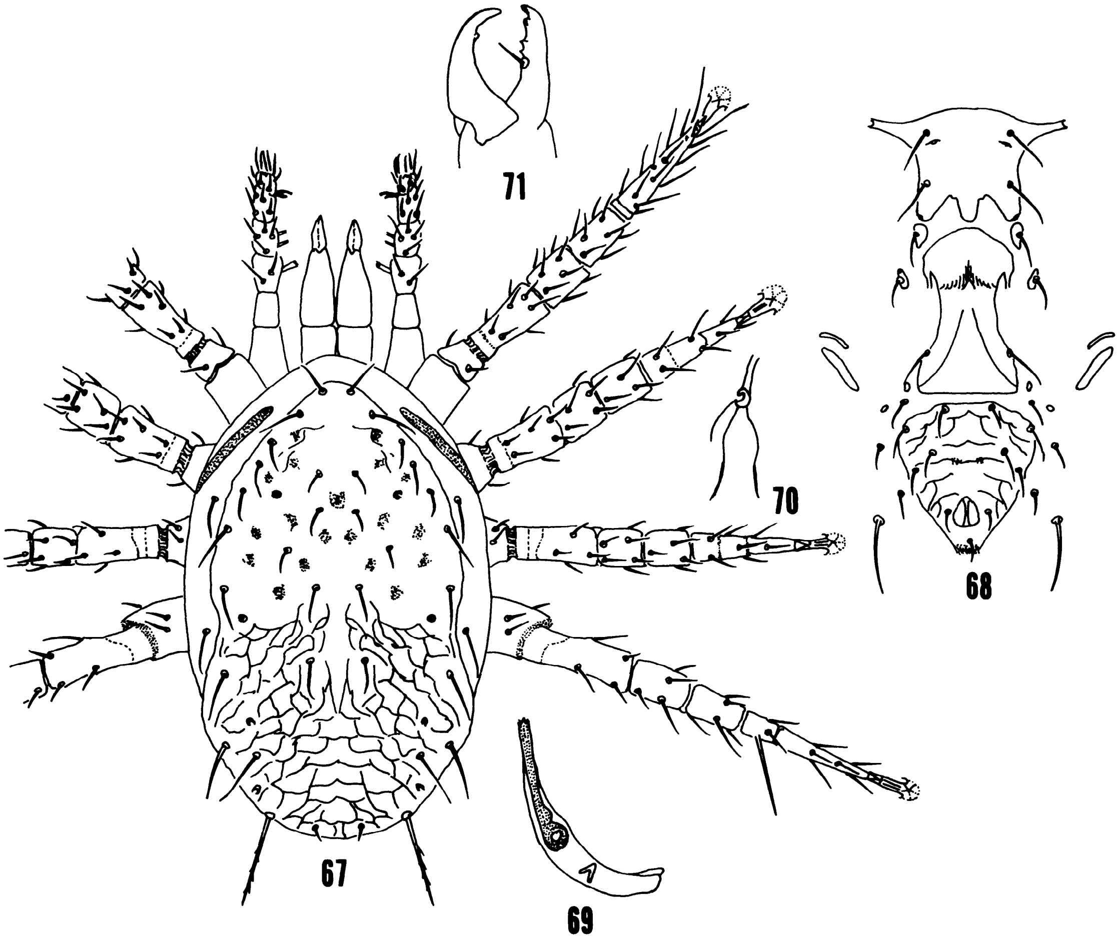
TYPE - Female holotype, U.S.A: Texas, Austin, 12 IV 1975, J. Welch, on *Quercus virginiana*, in FSCA.

DIAGNOSIS - See *Typhlodromus tiliae* Oudemans.

FEMALE - Length 414; width at L_5 185. Dorsal scutum reticulated with 4 large pores and 17 pairs of dorsal setae. Measurements of setae: verticals 31; D_1 22, D_2 22, D_3 28, D_4 31; clunals 9; L_1 38, L_2 27, L_3 35, L_4 31, L_5 36, L_6 41, L_7 45, L_8 50, L_9 64; M_1 27, M_2 48; anterior sublaterals 35; posterior sublaterals 36. Sternal scutum lightly creased anteriorly with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum lightly creased with a pair of small round pores, 4 pairs of preanal setae, and 3 pairs of ventrolateral setae. Chelicerae normal in relation to body size, fixed digit with 2 denticules, and movable digit with 1 denticule. Leg formula 1423. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with long saccular cervix 19 and c-shaped atrium.

MALE - Unknown.

DISCUSSION - This species is known only from the holotype and a paratype with the same collection data. Nothing is known about the biology of this species.



Figs. 67-71. *Typhlodromus setubali* Dosse. 67. Dorsal and leg structure and setation (female). 68. Ventrianal scuta and setation (female). 69. Posterior peritremal and stigmatal development (female). 70. Spermathecal structure (female). 71. Cheliceral structure (female).

Typhlodromus corticis Herbert
Fig. 60-66

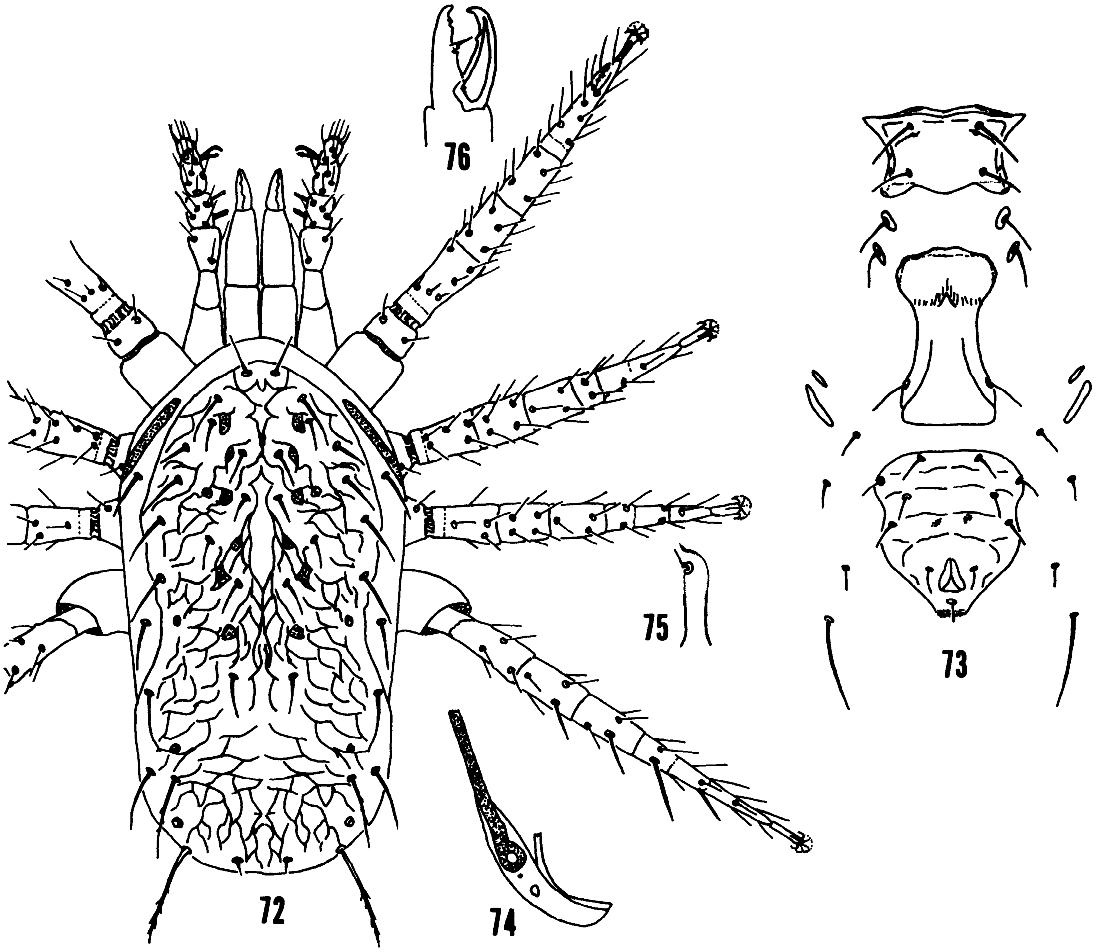
Typhlodromus corticis Herbert, 1958: 429; Rasmy and MacPhee, 1970: 173; Chant et al., 1974: 1274; Moraes et al., 1986: 243; Chant and Yoshida-Shaul, 1987: 1776.

Typhlodromus rodovae Wainstein and Arutunjan, 1968: 1241-1242, (TYPE: U.S.S.R.: S.S.R. Armenian, Noemberian, Academy Sciences Ukraine).

TYPE - Female holotype, Canada: Nova Scotia, Star's Point, 4 IV 1956, H.J. Herbert, from bark of apple tree, in CNC.

DIAGNOSIS - *Typhlodromus corticis* Herbert is similar to *Typhlodromus zaheri* Denmark n. sp. and *Typhlodromus setubali* Dosse but differs in having a pair of small round pores on the ventrianal scutum, dorsum reticulated, L_9 and M_2 smooth, and a short saccular cervix as apposed to having dorsum reticulated posterior only, long saccular cervix, and L_9 serrate in *setubali*, and L_9 and M_2 serrate, long narrow cervix, and dorsum reticulated entirely in *zaheri*.

FEMALE - Length 376; width at L_5 142. Dorsal scutum reticulated with 5 large pores, 3-4 small pores, and 17 pairs of setae. Measurements of setae: verticals 23; D_1 15-17, D_2 16-17, D_3 17-19, D_4 19-20; clunals 6; L_1 25-32, L_2 20, L_3 20-22, L_4 20-25, L_5 28, L_6 28-33, L_7 31-34, L_8 35, L_9 47-52; M_1 16, M_2 32; anterior sublaterals 27; posterior sublaterals 28. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum smooth with a pair of small round pores, 4 pairs of preanal setae, and 2-3 pairs of ventrolateral setae. Peritreme extending anteriorly between L_2 and L_3. Chelicerae normal in size in relation to body size, fixed digit with 3 denticules, and movable digit with 1 denticule. Leg formula 1423. Macrosetae Sge IV 26, Sti IV 24, and St IV 52. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with saccular cervix 16 and c-shaped atrium.



Figs. 72-76. *Typhlodromus zaheri* Denmark n. sp. 72. Dorsal and leg structure and setation (female). 73. Ventrianal scuta and setation (female). 74. Posterior peritremal and stigmatal development (female). 75. Spermathecal structure (female). 76. Cheliceral structure (female).

MALE - Similar to female but smaller in size. The spermatodactyl has foot terminal, lateral process present, and toe not enlarged. Ventrianal scutum smooth to lightly creased with a pair of small round pores and 4 pairs of preanal setae.

DISCUSSION - The allotype and 4 paratypes were collected with the holotype. Chant and Yoshida-Shaul (1987) reported additional records from Upper Canada and Nova Scotia. Chant and Yoshida-Shaul (1987) considered *Typhlodromus rodovae* Wainstein and Arutunjan to be a junior synonym of *T. corticis* and I concur with their placement. Nothing is known about the biology of this species. This description is based on a paratype. The holotype is not in good condition.

Typhlodromus setubali Dosse
Fig. 67-71

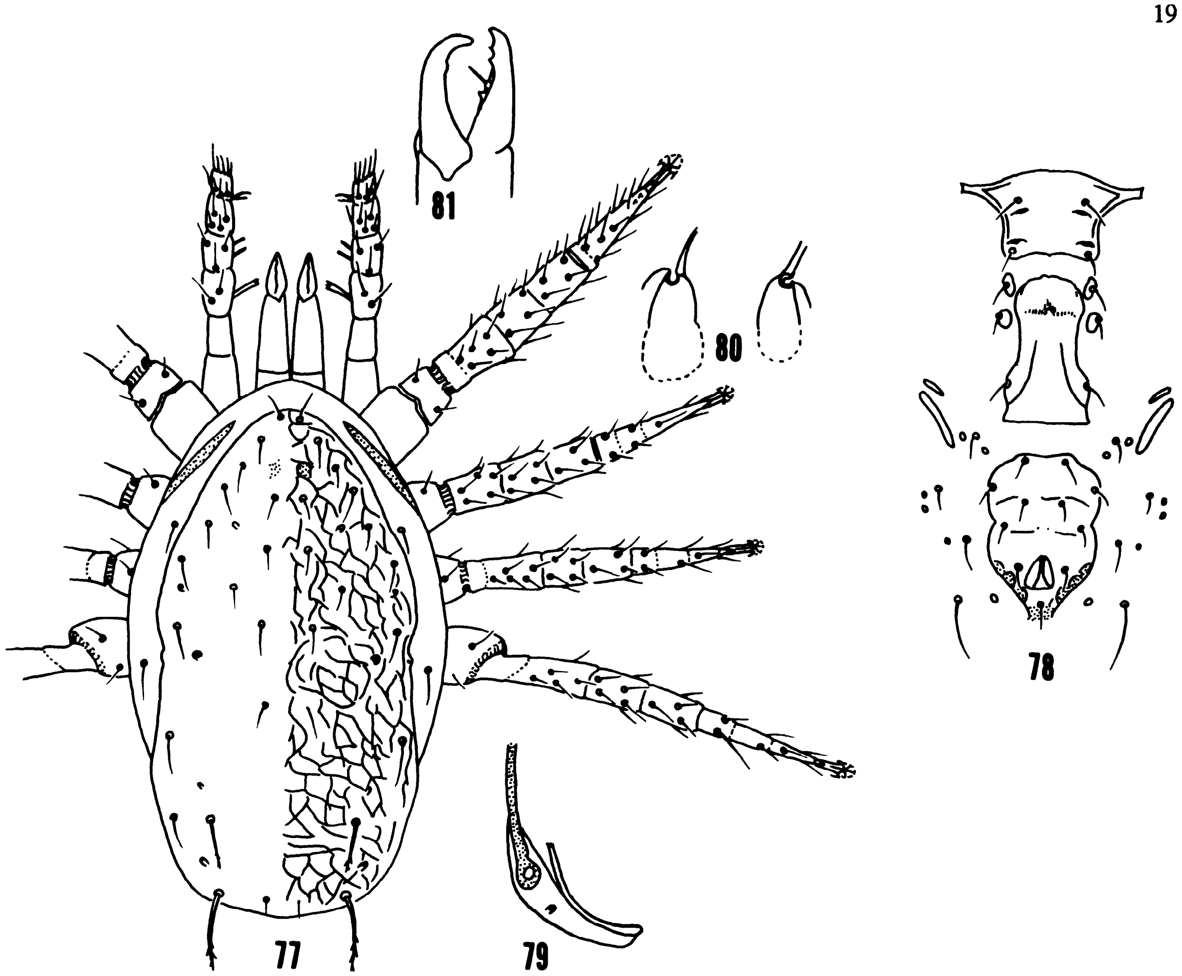
Typhlodromus setubali Dosse, 1961: 312-322; Karg, 1965: 51, 71, 72, 73; Moraes et al., 1986: 246; Chant and Yoshida-Shaul, 1987: 1778.

Typhlodromus laurentii Ragusa and Swirski, 1978: 213, 215, (TYPE: Piano Zucchi, Italy: Universita Degli Studi Palermo, Palermo, Italy).

TYPE - Female holotype, Portugal: Date?, G. Dosse, from *Quercus suber,* in Institute fur Pflanzenschutz der Landwirtschaftlichen Hochschule, Stuttgart-Hohenhein, Germany.

DIAGNOSIS - See *Typhlodromus corticis* Herbert.

FEMALE - Length 338; width at L_5 156. Dorsal scutum reticulated on the posterior half, scattered muscle marks anteriorly, 4 large pores, and 17 pairs of setae. Measurements of setae: verticals 24; D_1 17, D_2 17, D_3 20, D_4 22; clunals 3; L_1 28, L_2 19, L_3 25, L_4 27, L_5 29, L_6 28, L_7 33, L_8 35, L_9 63; M_1 17, M_2 36; anterior sublaterals 27; posterior sublaterals 25. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum creased with 4 pairs of preanal setae, and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to L_2. Chelicerae normal in size in relation



Figs. 77-81. *Typhlodromus atticus* Swirski and Ragusa. 77. Dorsal and leg structure and setation (female). 78. Ventrianal scuta and setation (female). 79. Posterior peritremal and stigmatal development (female). 80. Spermathecal structure (female). 81. Cheliceral structure (female).

to body size, fixed digit with 3 denticules, and movable digit with 1 denticule. Leg formula 4123. Macrosetae Sge IV 26, Sti IV 25, and St IV 50. Genu II 1-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with long saccular cervix 18 and c-shaped atrium.

MALE - Dosse (1961) illustrated the spermatodactyl. Foot terminal, no lateral process evident, and toe only slightly enlarged.

DISCUSSION - I concur with Chant and Yoshida-Shaul (1987) that all salient characters agree except for the chaetotactic formula of genu II in *setabuli* (1-2/-2/0-1) and *laurentii* (2-2-2/0-1). This may prove to be a separate species after more collections are made and the biology of the two species are known. Chant and Yoshida-Shaul (1987) reported additional collections from Spain, West Germany, and Italy. Host plants reported were: *Pyrus malus, Morus* sp., *Vitis vinifera, Rubus fructicosus, Picea sitkaensis, Quercus* sp., *Pinus nigra,* and *Acer negundo.* This description is based on a paratype specimen.

Typhlodromus zaheri Denmark n. sp.

Fig. 72-76

TYPE - Female holotype, Egypt: Mounofia, 29 X 1978, M.A. Zaher, on citrus leaves, in FSCA.

DIAGNOSIS - See *Typhlodromus corticis* Herbert.

FEMALE - Length 351; width at L_5 173. Dorsal scutum reticulated with 4 large pores, and 17 pairs of setae. Measurements of setae: verticals 29; D_1 20, D_2 22, D_3 27, D_4 27; clunals 4; L_1 38, L_2 22, L_3 33, L_4 29, L_5 38, L_6 45, L_7 37, L_8 46, L_9 76; M_1 22, M_2 53; anterior sublaterals 36; posterior sublaterals 33. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum lightly creased with 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to L_1. Chelicerae normal in relation to body size, fixed digit with 2 denticules, and movable digit with 1 denticule. Leg formula 4123. Macrosetae Sge IV 25, Sti IV 25, and St IV 48. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with long narrow cervix 20 and c-shaped atrium.

MALE - Unknown.

DISCUSSION - Only the type specimen is known for this species. Nothing is known about the biology.

ATTICUS GROUP

Two species are assigned to this group. They are *T. atticus* Swirski and Ragusa and *T. ernesti* Ragusa and Swirski. *T. atticus* is recognized in having only 1 macroseta on leg IV, peritreme extending anteriorly to L_1, L_9 36-49, and fixed digit with 3 denticules as apposed to 3 macrosetae on leg IV, peritreme extending anteriorly to L_2, L_9 56-61, and fixed digit with one denticule in *ernesti*.

Key to Females in *Atticus* Group

1. Leg IV with 3 macrosetae ....
.... *ernesti* Ragusa and Swirski, p. 20
Leg IV with 1 macroseta ....
.... *atticus* Swirski and Ragusa, p. 20

Typhlodromus atticus Swirski and Ragusa
Fig. 77-81

Typhlodromus atticus Swirski and Ragusa, 1976: 114; Moraes et al, 1986: 242; Chant and Yoshida-Shaul, 1987: 1779.

TYPE - Female holotype, Greece: Athens (Pnyx), 1 VIII 1972, E. Swirski, on *Pinus* sp., in Division of Entomology, ARO, Bet Dagan, Israel.

DIAGNOSIS - *Typhlodromus atticus* Swirski and Ragusa is similar to *Typhlodromus ernesti* Ragusa and Swirski but differs in having only 1 macroseta on leg IV, peritreme extending anteriorly to L_1, L_9 36-49, and fixed digit with 3 denticules as apposed to 3 macrosetae on leg IV, peritreme extending anteriorly to L_2, L_9 56-61, and fixed digit with one denticule in *ernesti*.

FEMALE - Length 353; width at L_5 170. Dorsal scutum reticulated with 4 medium size pores and 17 pairs of setae. Measurements of setae: verticals 22; D_1 14, D_2 16, D_3 19, D_4 20; clunals 6; L_1 25, L_2 19, L_3 22, L_4 22, L_5 27, L_6 29, L_7 30, L_8 26, L_9 36-49; M_1 16, M_2 33-35; anterior sublaterals 28; posterior sublaterals 24. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum lightly creased with 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to L_1. Chelicerae normal in relation to body size, fixed digit with 3 denticules, and movable digit with 1 denticule. Leg formula 1423. Macroseta St IV 42. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with short saccular cervix 7 and c-shaped atrium.

MALE - Unknown.

DISCUSSION - This species is known only from the holotype. Nothing is known of the life history or food habits.

Typhlodromus ernesti Ragusa and Swirski
Fig. 82-86

Typhlodromus ernesti Ragusa and Swirski, 1978: 211; Moraes et al, 1986: 243; Chant and Yoshida-Shaul, 1987: 1798.

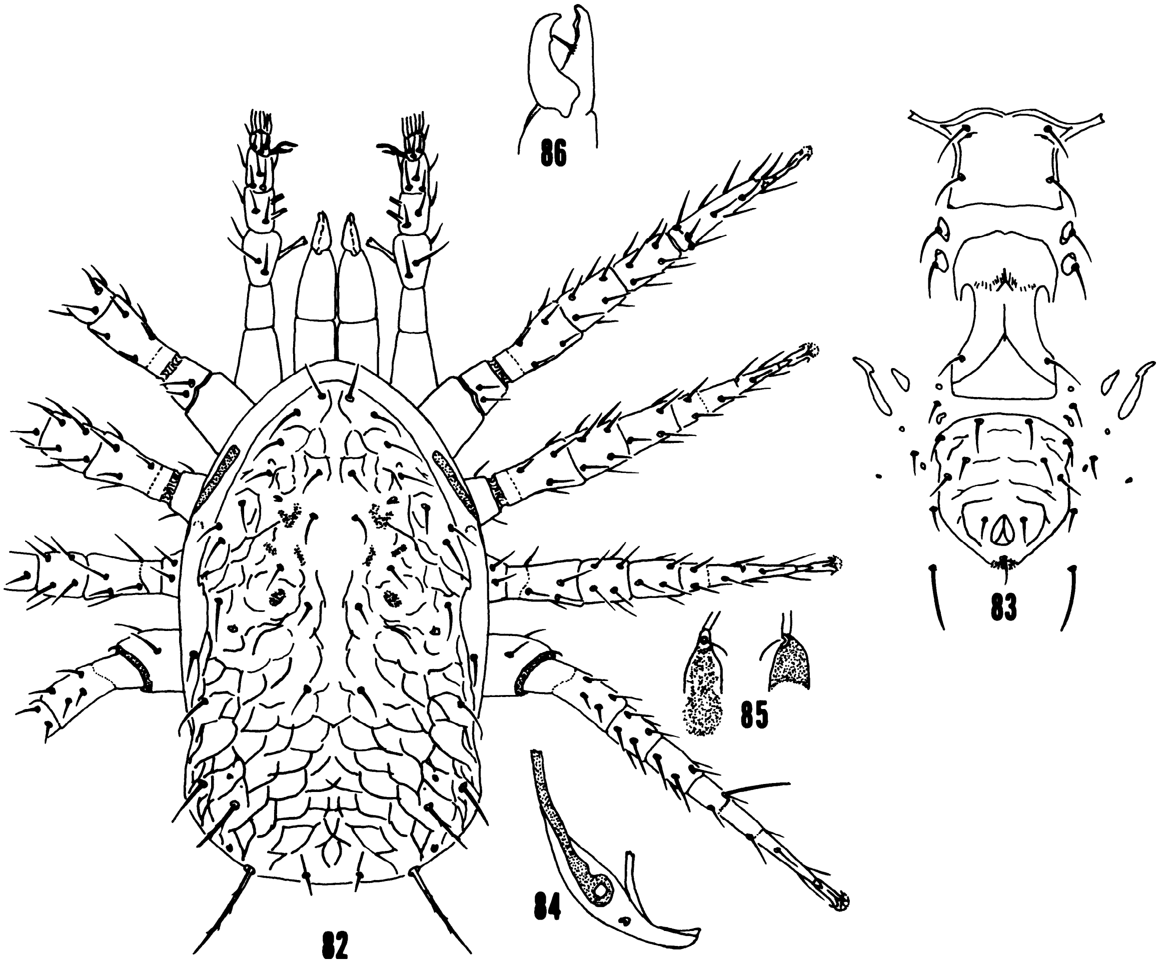
TYPE - Female holotype (No. 198b[1]), Italy: Monte Amiata, Tuscany, 6 VIII 1976, S. Ragusa, on *Taxus baccata*, in Instituto di Entomologia Agraria, Universita Degli Studi di Palermo, Palermo, Italy.

DIAGNOSIS - See *Typhlodromus atticus* Swirski and Ragusa.

FEMALE - Length 348-353; width at L_5 172. Dorsal scutum reticulated with 4 medium size pores and 17 pairs of setae. Measurements of setae: verticals 21-28; D_1 17, D_2 16-17, D_3 17, D_4 19-20; clunals 4-6; L_1 27-28, L_2 16-17, L_3 20-24, L_4 20-22, L_5 25-29, L_6 28-32, L_7 32, L_8 29-31, L_9 56-61; M_1 16-17, M_2 35; anterior sublaterals 17-22; posterior sublaterals 24-25. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum lightly creased with 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to L_2. Chelicerae normal in relation to body size, fixed digit with 1 denticule and movable digit with 1 denticule. Leg formula 4123. Macrosetae Sge IV 24-31, Sti IV 31 St IV 48-50. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with short saccular cervix 11 and c-shaped atrium.

MALE - Similar to female but smaller. Ventrianal scutum slightly creased with 4 pairs of preanal ventrianal setae. Spermatodactyl without foot and toe slightly enlarged in size and oval in shape.

DISCUSSION - The drawing illustrated by Chant and Yoshida-Shaul (1987) shows only 1 macroseta on leg IV and 4 denticules on the fixed digit. They reported variability in Canadian specimens. The type specimen and the illustration of Chant et al., have the anterior sublateral on the dorsal scutum. This same species was illustrated by Chant et al. (1974) as *T. pyri* with a pair of small round pores. The pores are missing in their illustration (1987). Four females were collected with the holotype. Chant et al. (1987) reports this species from West Germany, Switzerland, and Norway. Hosts include spruce, oak, white birch, *Juniperus communis, Pinus sylvestris,* and *Sorbus aucuparia.* They list hosts from Canada: cedar, balsam, hemlock, poplar, fir, fern, and plum. Nothing is known of the life history or food habits. This description is based on a paratype and a specimen from Norway collected on *Picea abies* by T. Edland.



Figs. 82-86. *Typhlodromus ernesti* Ragusa and Swirski. 82. Dorsal and leg structure and setation (female). 83. Ventrianal scuta and setation (female). 84. Posterior peritremal and stigmatal development (female). 85. Spermathecal structure (female). 86. Cheliceral structure (female).

ATHIASAE GROUP

Two species are assigned to this group. They are *T. athiasae* Porath and Swirski and *T. pritchardi* Arutunjan. These species have a saccular cervix and 3 macrosetae on leg IV. Peritreme extends anteriorly to L_1 in *athiasae* and to L_4 in *pritchardi.*

Key to Females in *Athiasae* Group

1. Ventrianal scutum with a pair of small round pores .... *pritchardi* Arutunjan, p. 23
   Ventrianal scutum without pores .... *athiasae* Porath and Swirski, p. 21

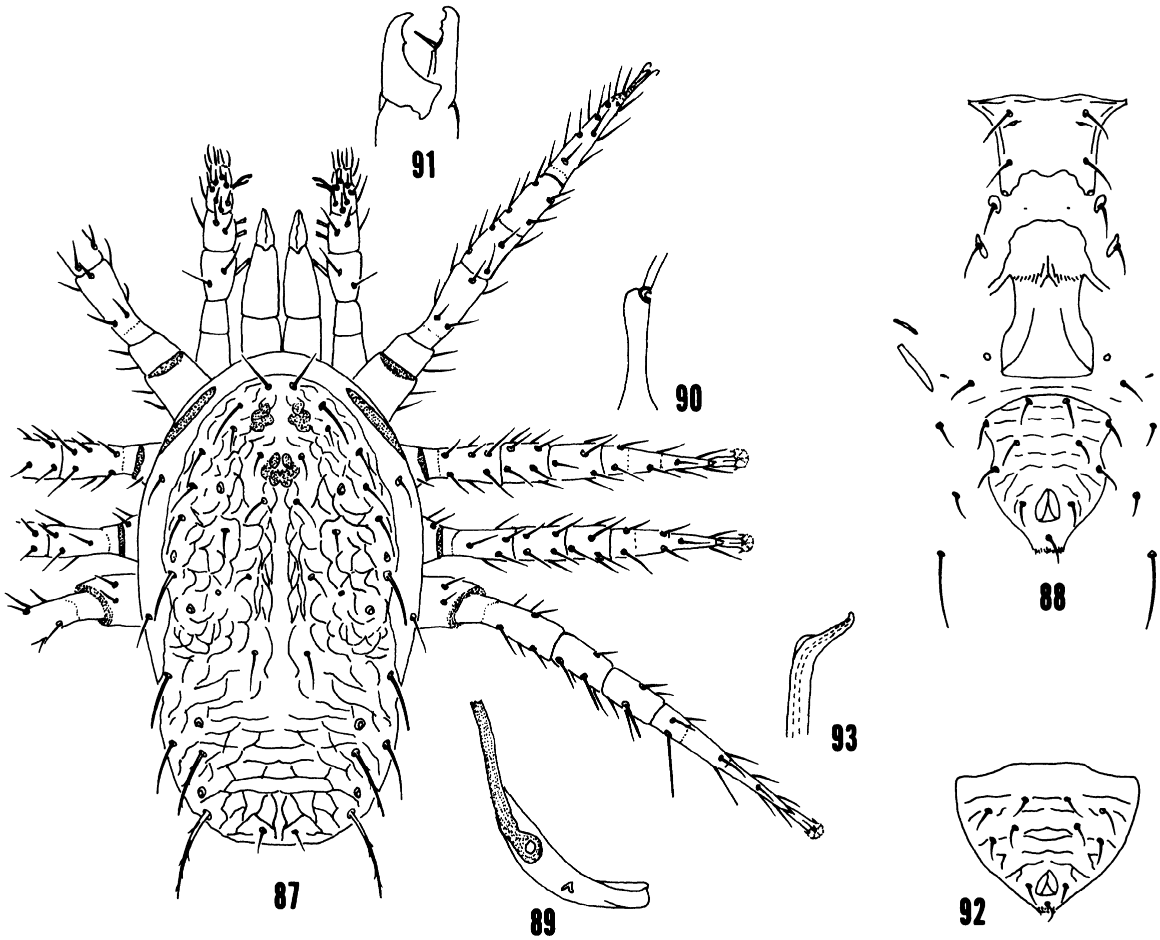
Typhlodromus athiasae Porath and Swirski
Fig. 87-93

Typhlodromus athiasae Porath and Swirski, 1965: 90; Swirski and Amitai, 1968: 100; McMurtry, 1972: 22; Amitai and Swirski, 1978: 134; Swirski and Amitai, 1982: 57; Ehara, 1966: 19; Moraes et al., 1986: 241; Chant and Yoshida-Shaul, 1987: 1791.

Typhlodromus perbibus Wainstein and Arutunjan, 1968: 1242 (TYPE: female holotype, U.S.S.R.: Armenia, Edzhevan, 15 VI 1958, D. Sh. Kalandadze, on *Juniperus* sp., in Institute of Zoology, Academy of Sciences of the Ukraine S.S.R., Kiev, U.S.S.R.), new synonym. *Typhlodromus siwa* El Badry, 1967: 183. (TYPE: Egypt: Siwa Oasis, Entomological Society of Egypt, Cairo, Egypt.).

Typhlodromus hellenicus Swirski and Ragusa, 1977: 75-79. (TYPE: Israel: Glefada (Corfu), 18 VI 1975, E. Swirski, on unidentified plant, in Division of Entomology, ARO, Bet Dagan, Israel).

Typhlodromus pelargonicus El Badry, 1968: 142-143. (TYPE: U.A.R., Egypt, Shubra, ? X 1965, E.A. El Badry, on leaves of *Pelargonium zonale,* in collection of the Entomological Society of Egypt).



Figs. 87-93. *Typhlodromus athiasae* Porath and Swirski. 87. Dorsal and leg structure and setation (female). 88. Ventrianal scuta and setation (female). 89. Posterior peritremal and stigmatal development (female). 90. Spermathecal structure (female). 91. Cheliceral structure (female). 92. Ventrianal scuta (male). 93. Spermatodactyl structure (male).

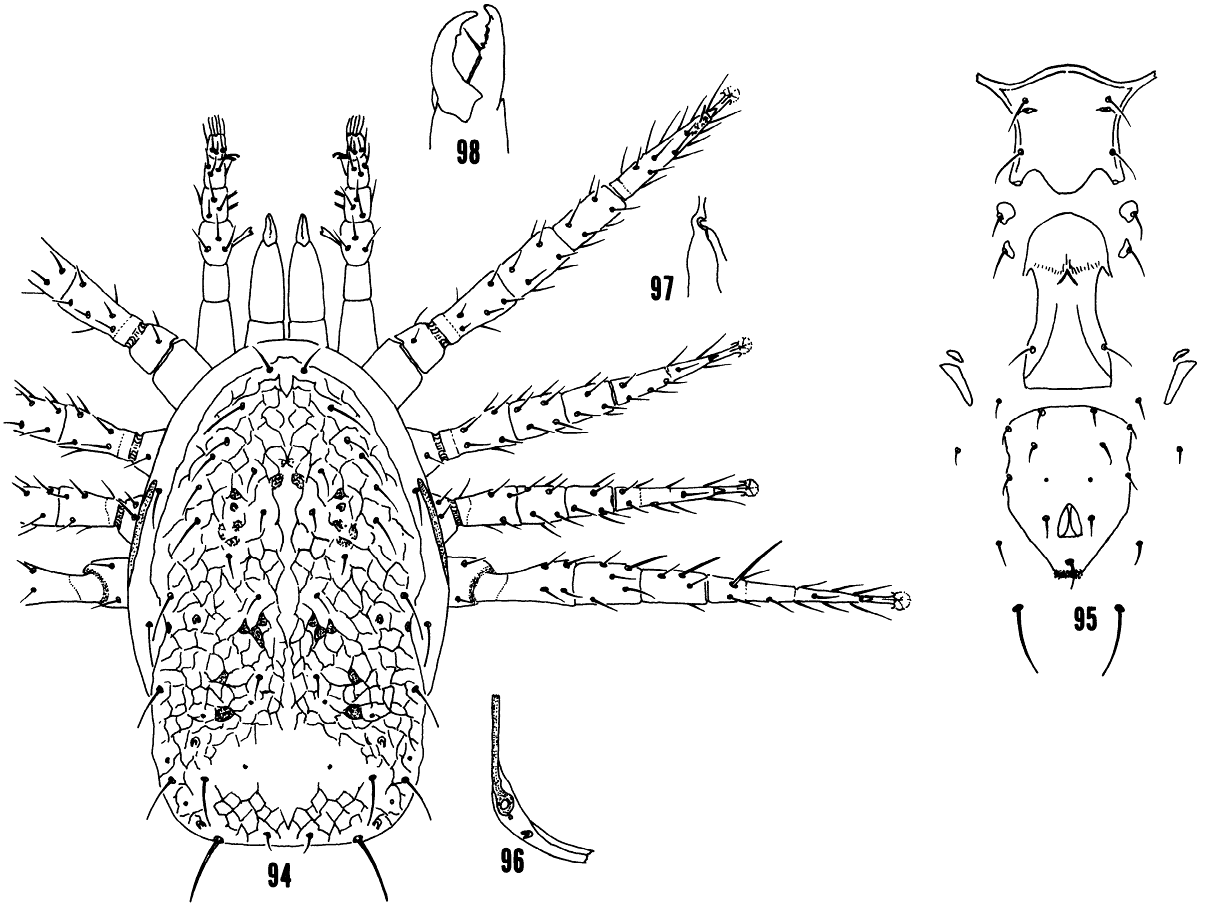
TYPE - Female holotype (No. 3460[3]), Israel: Rehovot, 23 I 1961, A. Porath and E. Swirski, on grapefruit, in Division of Entomology, ARO, Bet Dagan, Israel.

DIAGNOSIS - *Typhlodromus athiasae* Swirski and Ragusa is similar to *Typhlodromus pritchardi* Arutunjan but differs in having no pores on the ventrianal scutum, M_2 and L_8 are serrate, and peritreme extends anteriorly to L_1, as apposed to a pair of small round pores on the ventrianal scutum, M_2 and L_8 are smooth, and peritreme extending anteriorly to L_4 in *pritichardi.*

FEMALE - Length 328; width at L_5 170. Dorsal scutum reticulated with 4 large pores and 17 pairs of setae. Measurements of setae: verticals 25-27; D_1 17-19, D_2 18-19, D_3 20-24, D_4 24-25; clunals 4-5; L_1 35-37, L_2 19-20, L_3 24-27, L_4 20-27, L_5 27-33, L_6 33-36, L_7 36-41, L_8 42-47, L_9 71-79; M_1 17-22, M_2 50; anterior sublaterals 32; posterior sublaterals 23-28. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum lightly creased with 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to L_1. Chelicerae normal in relation to body size, fixed digit with 2-3 denticules, and movable digit with 1 denticule. Leg formula 4123. Macrosetae Sge IV 19-25, Sti IV 25-28, St IV 44-53. Genu II 2-2/1-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with long saccular cervix 20-23 and c-shaped atrium.

MALE - Similar to females but smaller in size. The spermatodactyl has foot terminal with toe slightly enlarged. The ventrianal scutum creased with 4 pairs of preanal setae.

DISCUSSION - This species is known from Israel, Egypt, and Turkey on various hosts (Porath and Swirski, 1965; Amitai and Swirski, 1978; Swirski et al., 1967; and Wysoki and Swirski, 1968, 1971) reported laboratory and field studies on *T. athiasae*. Wysoki and Swirski (1968) reported that this species has a haploid number of 4 and a diploid number of 8. Comparison of the



Figs. 94-98. *Typhlodromus pritchardi* Arutunjan. 94. Dorsal and leg structure and setation (female). 95. Ventrianal scuta and setation (female). 96. Posterior peritremal and stigmatal development (female). 97. Spermathecal structure (female). 98. Cheliceral structure (female).

types of *athiasae* and *perbibus* shows these two species to be conspecific. Chant and Yoshida-Shaul (1987) consider *perbibus* to be a subspecies of *athiasae*. This description is based on a paratype and a female and male specimen from Jordan collected in 1987 by G. Zein on unknown host.

Typhlodromus pritchardi Arutunjan
Fig. 94-98

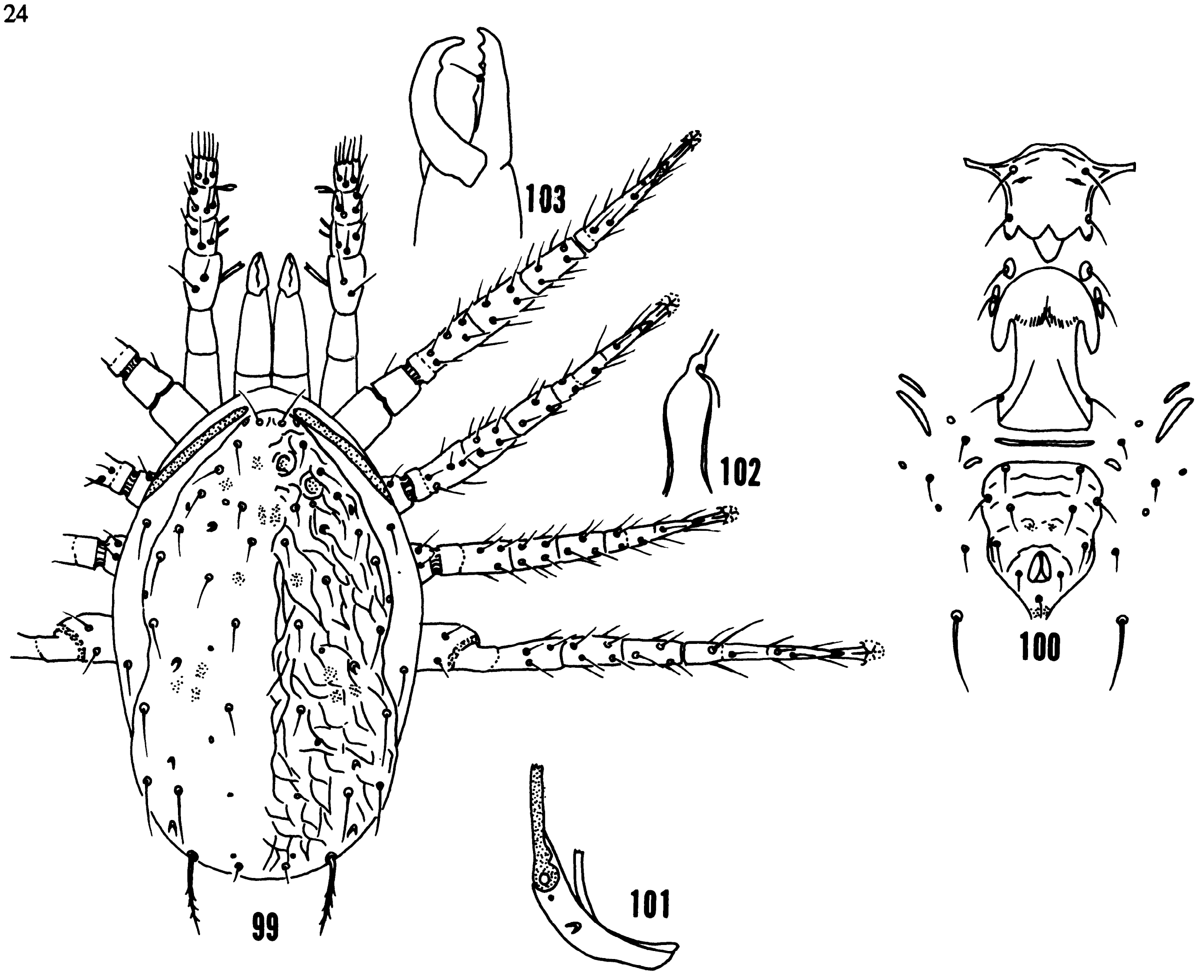
Typhlodromus pritchardi Arutunjan, 1971: 306; Wainstein, 1975: 915; Arutunjan, 1977: 46; Kolodochka, 1981: 18; Moraes et al., 1986: 246; Chant and Yoshida-Shaul, 1987: 1800; Denmark, 1992: 13.

TYPE - Female holotype (No. 450), U.S.S.R.: Idzhebansk Region, Kurants Forest Cooperative (800m above sea level), Armenian S.S.R., 12 VII 1968, from a strawberry plant, in Zoological Institute of the Armenian Academy of Science, Yerevan, Armenian S.S.R.

DIAGNOSIS - See *Typhlodromus athiasae* Porath and Swirski.

FEMALE - Length 392-405; width at L_5 192-201. Dorsum scutum reticulated with 4 large pores, 2-3 small pores, and 17 pairs of setae. Measurements of setae: verticals 27; D_1 15-16, D_2 14-15, D_3 18-19, D_4 21; clunals 8; L_1 33, L_2 15-17, L_3 28-30, L_4 24-25, L_5 31-36, L_6 31-36, L_7 36-39, L_8 38-39, L_9 53-60; M_1 18, M_2 33-37; anterior sublaterals 29; posterior sublaterals 35. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum smooth with a pair of small pores, 4 pairs of setae, and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to L_4. Chelicerae normal in relation to body size, fixed digit with 4 denticules, movable digit with 2 denticules. Leg formula 1423. Macrosetae Sge IV 27, Sti IV 29, St IV 35. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with saccular cervix 15 and c-shaped atrium.

MALE - Unknown.



Figs. 99-103. *Typhlodromus ulex* Evans. 99. Dorsal and leg structure and setation (female). 100. Ventrianal scuta and setation (female). 101. Posterior peritremal and stigmatal development (female). 102. Spermathecal structure (female). 103. Cheliceral structure (female).

DISCUSSION - The illustration and description are based on a specimen loaned to me by L.A. Kolodochka collected near Massandra, Crimea, Ukraine, 23 VI 1976, L.A. Kolodochka, from *Primula vulgaris* (No. 2186). I was unable to borrow the type specimen. Chant and Yoshida-Shaul (1987) indicated that this species is very close to *Typhlodromus andrei* Karg. The spermathecae are distinct in the two species based on the specimen borrowed from Dr. Kolodochka. Nothing is known about the life history or food habits.

ULEX GROUP

Four species are assigned to this group. They are *T. ulex* Evans, *T. phialatus* Athias-Henriot, *T. klimenkoi* Kolodochka, and *T. laurae* Arutunjan. All species have spermatheca medium to long saccular with c-shaped atrium. *T. ulex, T. klimenkoi,* and *T. phialatus* have 1 macroseta on leg IV and reticulate dorsal scutum. *T. laurae* has 3 macrosetae on leg IV and reticulated dorsal scutum.

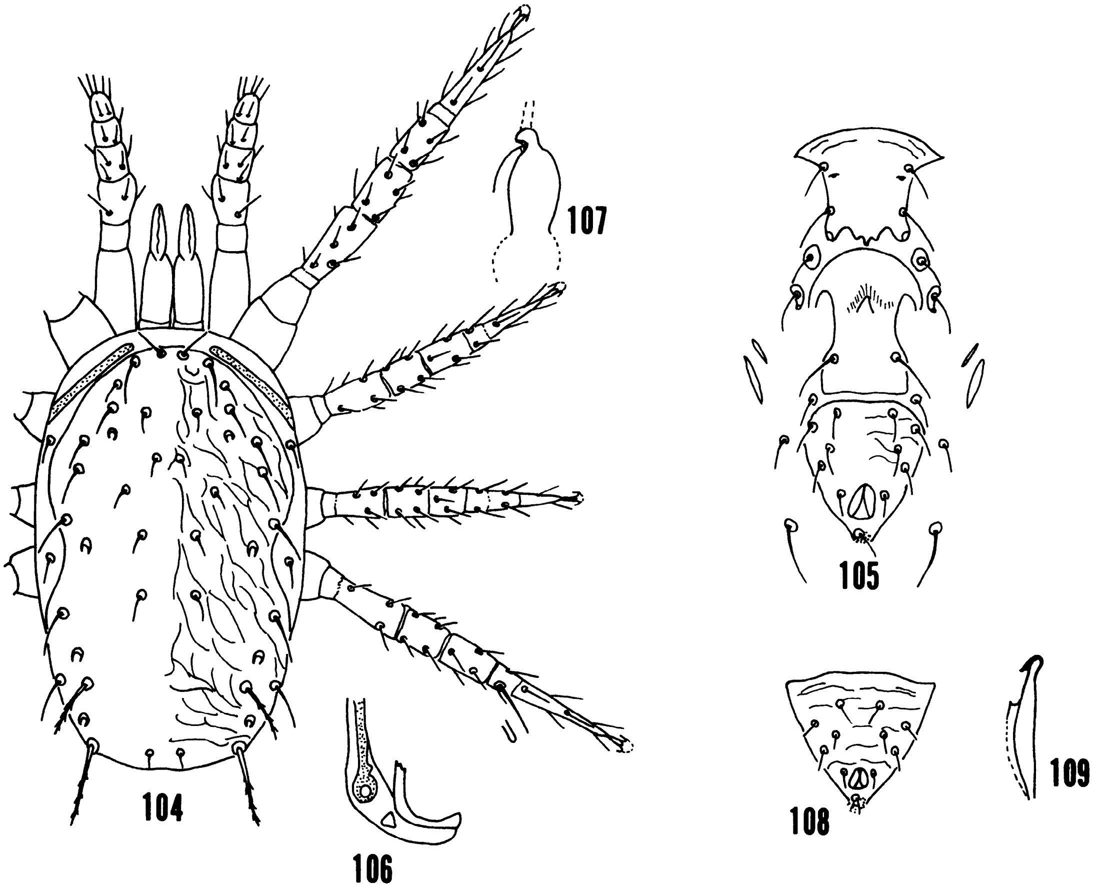
Key to Females in *Ulex* Group

1. Leg IV with 3 macrosetae ....
   .... *laurae* Arutunjan, p. 28
   Leg IV with 1 macroseta 2
2. Peritreme extending anteriorly to L_4 or L_5, L_9 smooth
   .... *klimenkoi* Kolodochka, p. 27
   Peritreme extending anteriorly to L_1 or verticals, L_9 serrate 3
3. M_2 smooth and peritreme extending anteriorly to verticals .... *ulex* Evans, p. 24
   M_2 serrate and peritreme extending anteriorly to L_1
   .... *phialatus* Athias-Henriot, p. 25

Typhlodromus ulex Evans
Fig. 99-103

Typhlodromus ulex Evans, 1988: 73.

TYPE - Female holotype, England: Yateley Commons, Hampshire, 15 VII 1984, R.L. Hill, on Ulex europaeus, in British Museum of Natural History.



Figs. 104-109. *Typhlodromus phialatus* Athias-Henriot. 104. Dorsal and leg structure and setation (female). 105. Ventrianal scuta and setation (female). 106. Posterior peritremal and stigmatal development (female). 107. Spermathecal structure (female). 108. Ventrianal scuta (male). 109. Spermatodactyl structure (male).

DIAGNOSIS - *Typhlodromus ulex* Evans is similar to *Typhlodromus phialatus* Athias-Henriot but differs in having M_2 smooth, peritreme extending anteriorly to verticals, and leg formula 4123 as apposed to M_2 serrate, peritreme extending anteriorly to L_1, and leg formula 1423 in *phialatus*.

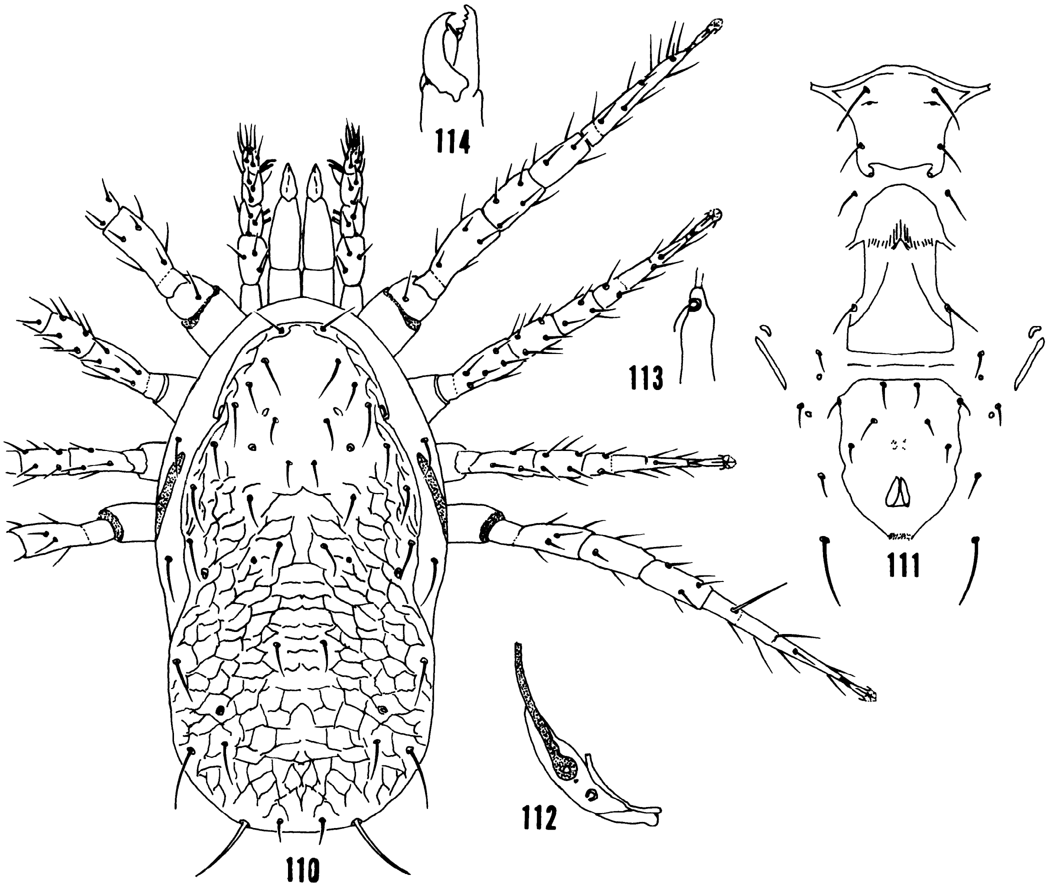
FEMALE - Length 325; width at L_5 169. Dorsal scutum reticulated 4 large pores, 4-5 small pores, and 17 pairs of setae. Measurements of setae: verticals 17; D_1 17, D_2 17, D_3 19, D_4 20; clunals 4; L_1 17, L_2 17, L_3 19, L_4 17, L_5 24, L_6 27, L_7 33, L_8 33, L_9 52; M_1 18, M_2 42; anterior sublaterals 21; posterior sublaterals 25. Sternal scutum smooth, 2 pairs of pores, and 2 pairs of setae. Ventrianal scutum lightly creased with 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to verticals. Chelicerae normal in relation to body size, fixed digit with 3 denticules, movable digit with 1 denticule. Leg formula 4123. Macroseta St IV 30. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with long saccular cervix 18 and c-shaped atrium.

MALE - Unknown.

DISCUSSION - This species is known only from the type specimen. It is very close to *T. phialatus* Athias-Henriot in all measurements. There are a few minor differences such as the length of peritreme, smooth M_2, lengths of legs I and IV, and a slightly longer spermatheca. These differences may prove to be variations, but additional collections of this species should resolve this problem. In the meantime *ulex* is considered a valid species. This description is based on the holotype specimen.

Typhlodromus phialatus Athias-Henriot
Fig. 104-109

Typhlodromus phialatus Athias-Henriot, 1960: 100; Wainstein, 1975: 915; Arutunjan, 1977: 46; Amitai



Figs. 110-114. *Typhlodromus klimenkoi* Kolodochka. 110. Dorsal and leg structure and setation (female). 111. Ventrianal scuta and setation (female). 112. Posterior peritremal and stigmatal development (female). 113. Spermathecal structure (female). 114. Cheliceral structure (female).

and Swirski, 1978: 136; Kolodochka, 1978: 53; 1980: 43; 1981: 18; Moraes et al., 1986: 245.

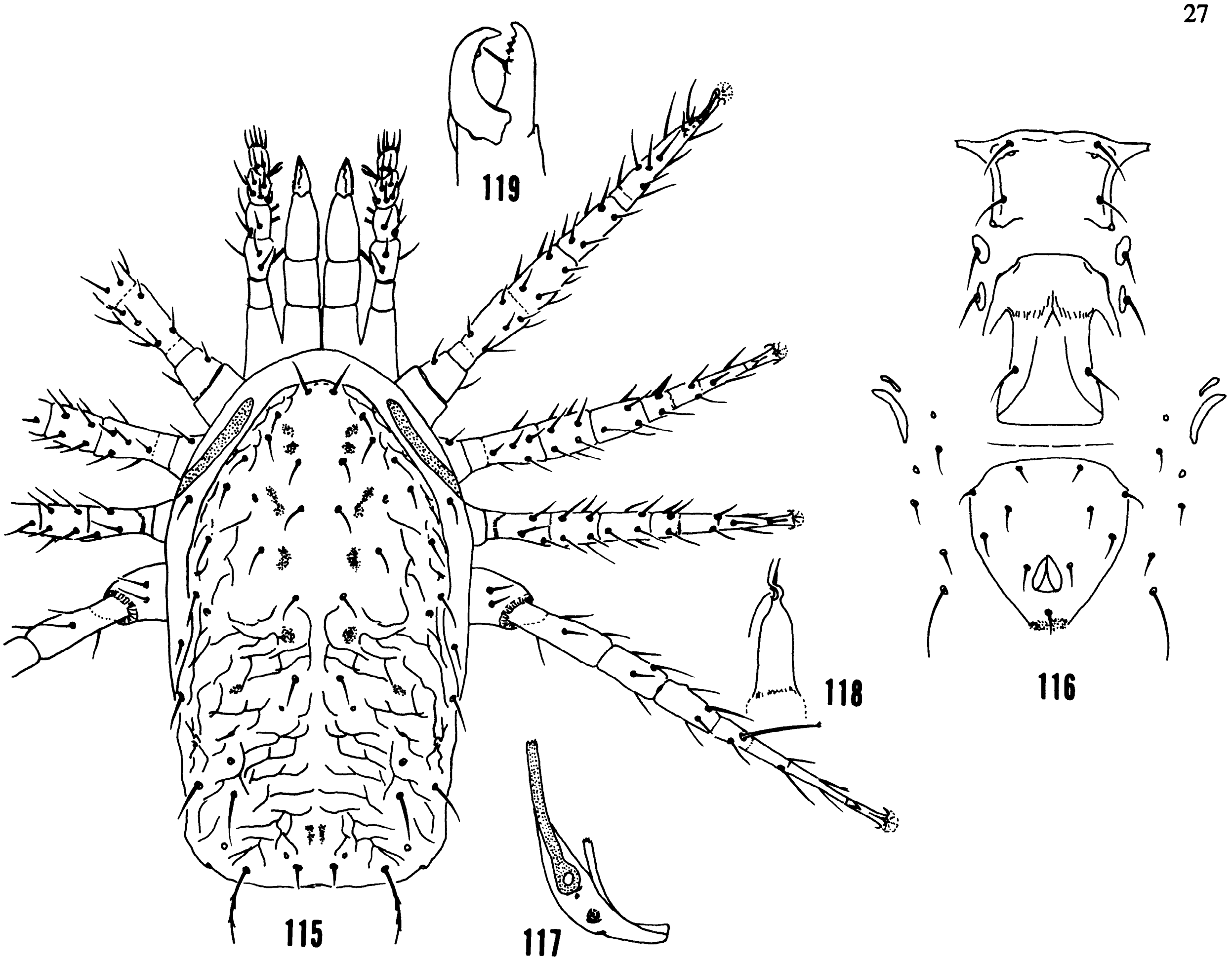
TYPE - Syntype, Algeria: Bouzareak, Valley of the Wadi Bouzareak, 4 X 1959, C. Athias-Henriot, on the following hosts: *Calamintha clinopodium, C. heterotricha, Pteris aquilina, Cistus salviifolius, Louicera implexa, Quercus suber,* and *Arbutus imedo* in Station Biologique, Les Eyzies, France and in Department Arthropodes, Musee d'Histoire Naturelle, Geneva, Switzerland.

DIAGNOSIS - See *Typhlodromus ulex* Evans.

FEMALE - Length 236; width at L_5 141. Dorsal scutum reticulated with 4 large pores and 17 pairs of setae. Measurements of setae: verticals 21; D_1 12, D_2 13, D_3 17, D_4 19; clunals 5; L_1 22, L_2 15, L_3 24, L_4 24, L_5 25, L_6 27, L_7 32, L_8 32, L_9 54; M_1 14, M_2 39; anterior sublaterals 27; posterior sublaterals 26. Sternal scutum smooth with 2 pairs of pores, and 2 pairs of setae. Ventrianal scutum smooth with 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to L_1. Chelicerae normal in relation to body size, fixed digit with 1 denticule, movable digit with 2 denticules. Leg formula 1423. Macroseta St IV 33. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca saccular cervix 15 and c-shaped atrium.

MALE - Similar to female but smaller. Ventrianal scutum lightly creased with 5 pairs of preanal setae. Spermatodactyl appears as straight shaft rather than usual foot and toe.

DISCUSSION - Athias-Henriot (1960) reported this species from U.S.S.R. and Israel. Chant and Yoshida-Shaul (1987) doubts the identity of these specimens. They also believe Kolodochka's description of *phialatus* (1978, 1980, 1981) more nearly fits *T. laurae*. Wysoki (1973) reported that *T. phialatus* has a haploid number of 4 chromosomes and a diploid number of 8. This description is based on a syntype specimen.



Figs. 115-119. *Typhlodromus laurae* Arutunjan. 115. Dorsal and leg structure and setation (female). 116. Ventrianal scuta and setation (female). 117. Posterior peritremal and stigmatal development (female). 118. Spermathecal structure (female). 119. Cheliceral structure (female).

Typhlodromus klimenkoi Kolodochka
Fig. 110-114

Typhlodromus klimenoi Kolodochka, 1980: 68; Moraes et al., 1986: 244; Chant and Yoshida, 1987: 1785.

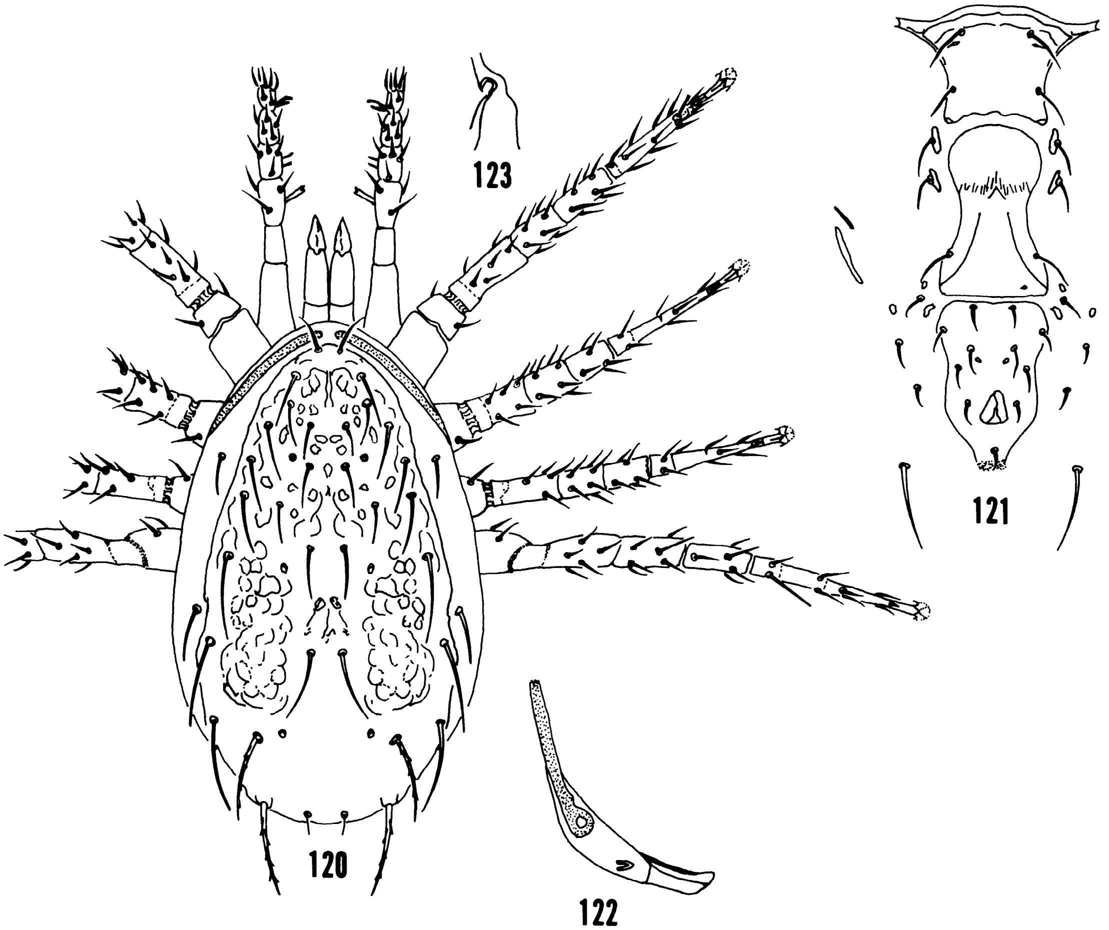
TYPE - Female holotype (No. 2772b), U.S.S.R.: Kyrgoo, Leninskii District, Oshskaia Region, Kirgizskaia, 11 VIII 1977, from pistachio, in Institute of Zoology, Academy of Science of the Ukraine S.S.R., Kiev, U.S.S.R.

DIAGNOSIS - *Typhlodromus klimenkoi* Kolodochka is similar to *Typhlodromus laurae* Arutunjan but differs in having L_9 smooth, peritreme extending anteriorly between L_4 and L_5, and macroseta St IV is pointed as apposed to L_9 serrate, peritreme extending anteriorly to L_1, and macroseta St IV spatulate in *laurae*.

FEMALE - Length 400; width at L_5 173. Dorsal scutum reticulated with 3 large pores, a pair of small pores, and 17 pairs of setae. Measurements of setae: verticals 24; D_1 22, D_2 20, D_3 27, D_4 31; clunals 9; L_1 32, L_2 20, L_3 35, L_4 32, L_5 31, L_6 35, L_7 37, L_8 47, L_9 50; M_1 20, M_2 35; anterior sublaterals 25; posterior sublaterals 36. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum smooth with 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly between L_4 and L_5. Chelicerae normal in relation to body size, fixed digit with 3 denticules, and movable digit with 1 denticule. Leg formula 1423. Macroseta St IV 47. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca saccular cervix 15 and c-shaped atrium.

MALE - Unknown.

DISCUSSION - Chant and Yoshida-Shaul (1987) illustrate this species with 4 large pores. I did not find the pore between L_8 and L_9 on the holotype. They show leg IV to be the longest. I found leg I to be the longest. This species in known only from the holotype. Nothing is known about the life history or food habits. This description is based on the holotype specimen.



Figs. 120-123. *Typhlodromus swirskii* Denmark. 120. Dorsal and leg structure and setation (female). 121. Ventrianal scuta and setation (female). 122. Posterior peritremal and stigmatal development (female). 123. Spermathecal structure (female).

***Typhlodromus laurae* Arutunjan**
Fig. 115-119

Typhlodromus laurae Aruntunjan, 1974: 57; 1977: 47; Moraes et al., 1986: 244.

TYPE - Female holotype, U.S.S.R.: Nr. Guilagarak, Stepanavan, Armenian S.S.R., 12 VII 1971, from pine, in the Zoological Institute of the Academy of Sciences of the Armenian S.S.R.

DIAGNOSIS - See *Typhlodromus klimenkoi* Kolodochka.

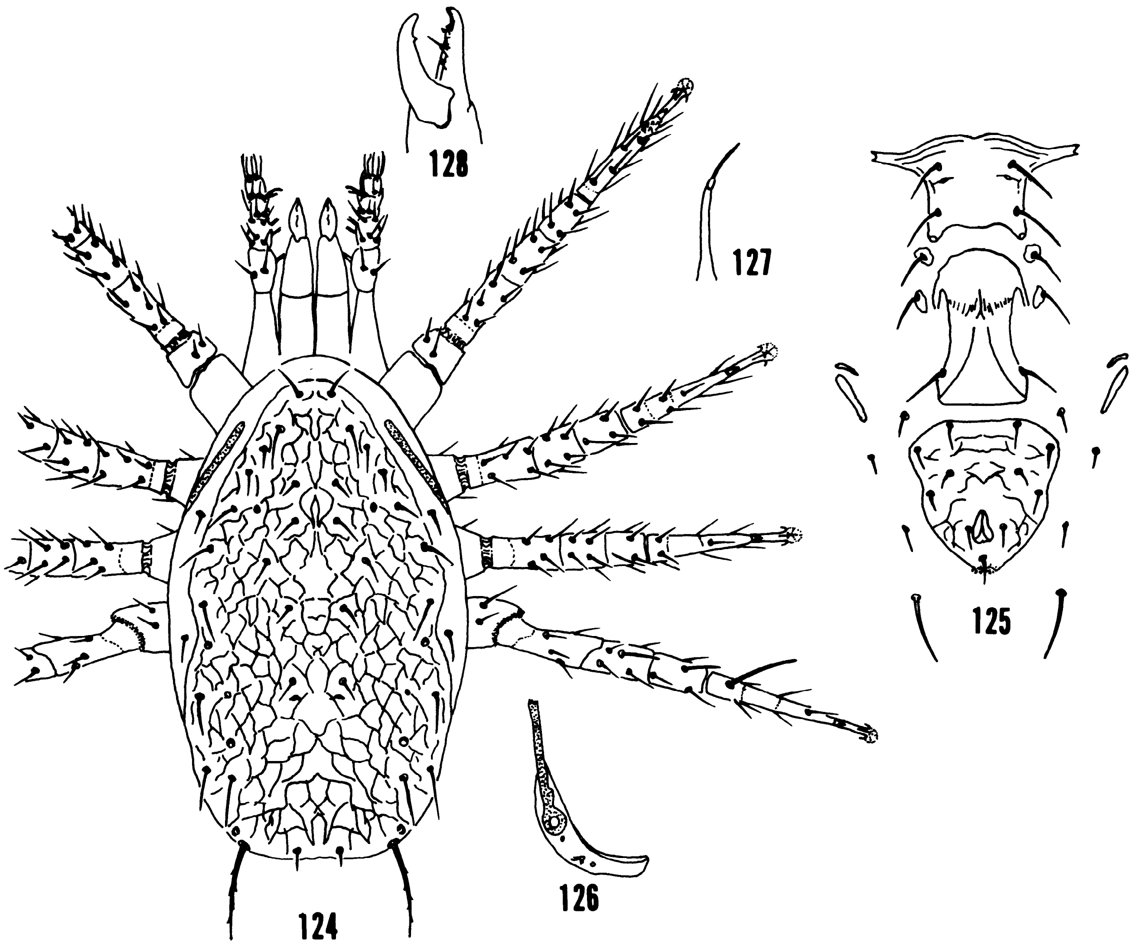
FEMALE - Length 369; width at L_5 188. Dorsal scutum reticulated posteriorly with muscle marks anteriorly, 4 large pores and 17 pairs of setae. Measurements of setae: verticals 17-25; D_1 12-13, D_2 12-13, D_3 15-16, D_4 16-18; clunals 3-5; L_1 17-20, L_2 17, L_3 17, L_4 19, L_5 18-22, L_6 22-25, L_7 25-28, L_8 36, L_9 47-55; M_1 11-13, M_2 28; anterior sublaterals 19-20; posterior sublaterals 17-20. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum smooth with 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to L_1. Chelicerae normal in relation to body size, fixed digit with 2-3 denticules, and movable digit with 1-2 denticules. Leg formula 4123. Macrosetae Sge IV 20-22, Sti IV 33, St IV 53. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with long saccular cervix 20-25 and c-shaped atrium.

MALE - Unknown.

DISCUSSION - In addition to the type specimen, I examined a specimen from Valle, Valle, Norway, 15 X 1988, T. Edland, on *Pinus syvestris*. Nothing is known about the biology of this species.

UNASSIGNED GROUP

Three species are assigned here as I am unable to place them in any of the other species groups primarily because of their unique spermathecae. The unassigned species are: *T. swirskii* Denmark, *T. moroccoensis* Denmark, and *T. baccettii* Lombardini.



Figs. 124-128. *Typhlodromus moroccoensis* Denmark. 124. Dorsal and leg structure and setation (female). 125. Ventrianal scuta and setation (female). 126. Posterior peritremal and stigmatal development (female). 127. Spermathecal structure (female). 128. Cheliceral structure (female).

Typhlodromus swirskii **Denmark**
Fig. 120-123

Typhlodromus swirskii Denmark, 1992: 15.

TYPE - Female holotype, Egypt: Giza, 9 X 1978, on mango leaves, in FSCA.

DIAGNOSIS - *T. swirskii* has a saccular cervix with a large c-shaped atrium, M_2, L_6, L_7, L_8, and L_9 approximately the same length.

FEMALE - Length 331; width at L_5 160. Dorsal scutum reticulated from D_1 to D_4, 4 medium size pores, and 17 pairs of setae. Measurements of setae: verticals 27; D_1 25, D_2 27, D_3 39, D_4 49; clunals 10; L_1 33, L_2 27, L_3 39, L_4 35, L_5 45, L_6 57, L_7 63, L_8 68, L_9 60; M_1 27, M_2 55; anterior sublaterals 34; posterior sublaterals 36. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum smooth with a pair of small pores, 4 pairs of preanal setae, and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to the verticals. Chelicerae normal in relation to body size, but I was unable to see the denticules on the digits as they were not positioned correctly. Leg formula 4123. Macroseta St IV 34. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with saccular cervix 13 and large c-shaped atrium.

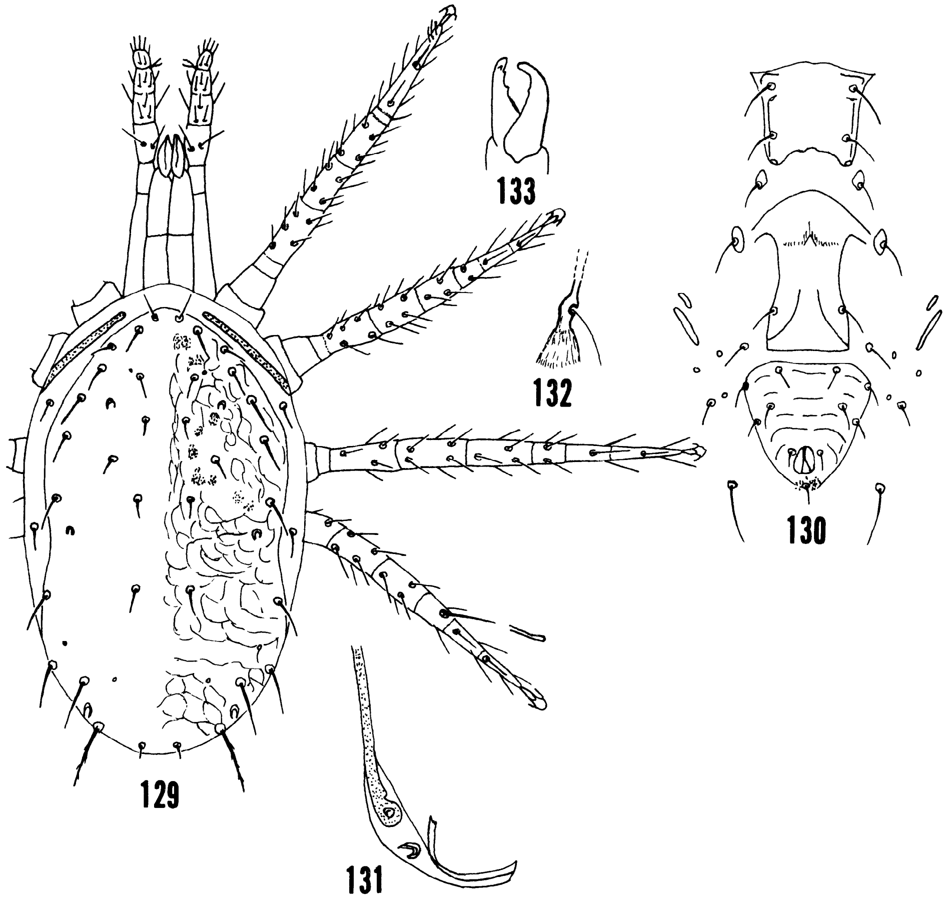
MALE - Unknown.

DISCUSSION - This species is known from the type specimens. Nothing is known about the life history and biology of this species. It was named in honor of Professor Eliahu Swirski in commemoration of his 70th birthday and his contributions to acarology (Denmark, 1992).

Typhlodromus moroccoensis **Denmark**
Fig. 124-128

Typhlodromus moroccoensis Denmark, 1992: 16.

TYPE - Female holotype, Morocco: Debdou, 2 IV 1973, F.S. Saba, on *Prunus* sp., in FSCA.



Figs. 129-133. *Typhlodromus baccettii* Lombardini. 129. Dorsal and leg structure and setation (female). 130. Ventrianal scuta and setation (female). 131. Posterior peritremal and stigmatal development (female). 132. Spermathecal structure (female). 133. Cheliceral structure (female).

DIAGNOSIS - *Typhlodromus moroccoensis* Denmark n. sp. is distinct from other known species of *Typhlodromus* in its combination of characters: tubular-fundibular cervix, 3 macrosetae on leg IV, 4 medium size pores on the dorsal scutum, 3 pairs of ventrolateral setae, and 4 pairs of preanal setae.

FEMALE - Length 330; width at L_5 176. Dorsal scutum reticulated, 4 medium size pores, and 17 pairs of setae. Measurements of setae: verticals 27; D_1 15, D_2 14, D_3 16, D_4 19; clunals 4; L_1 27, L_2 17, L_3 19, L_4 19, L_5 24, L_6 29, L_7 32, L_8 32, L_9 62; M_1 17, M_2 42; anterior sublaterals 25; posterior sublaterals 25. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum lightly creased with 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to the level of L_1. Chelicerae normal in relation to body size, fixed digit with 4 denticules, and movable digit with 1 denticule. Leg formula 4123. Macrosetae Sge IV 22, Sti IV 27, and St IV 46. Genu II 1-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with tubular-fundibular cervix 20 and undifferentiated atrium.

MALE - Unknown.

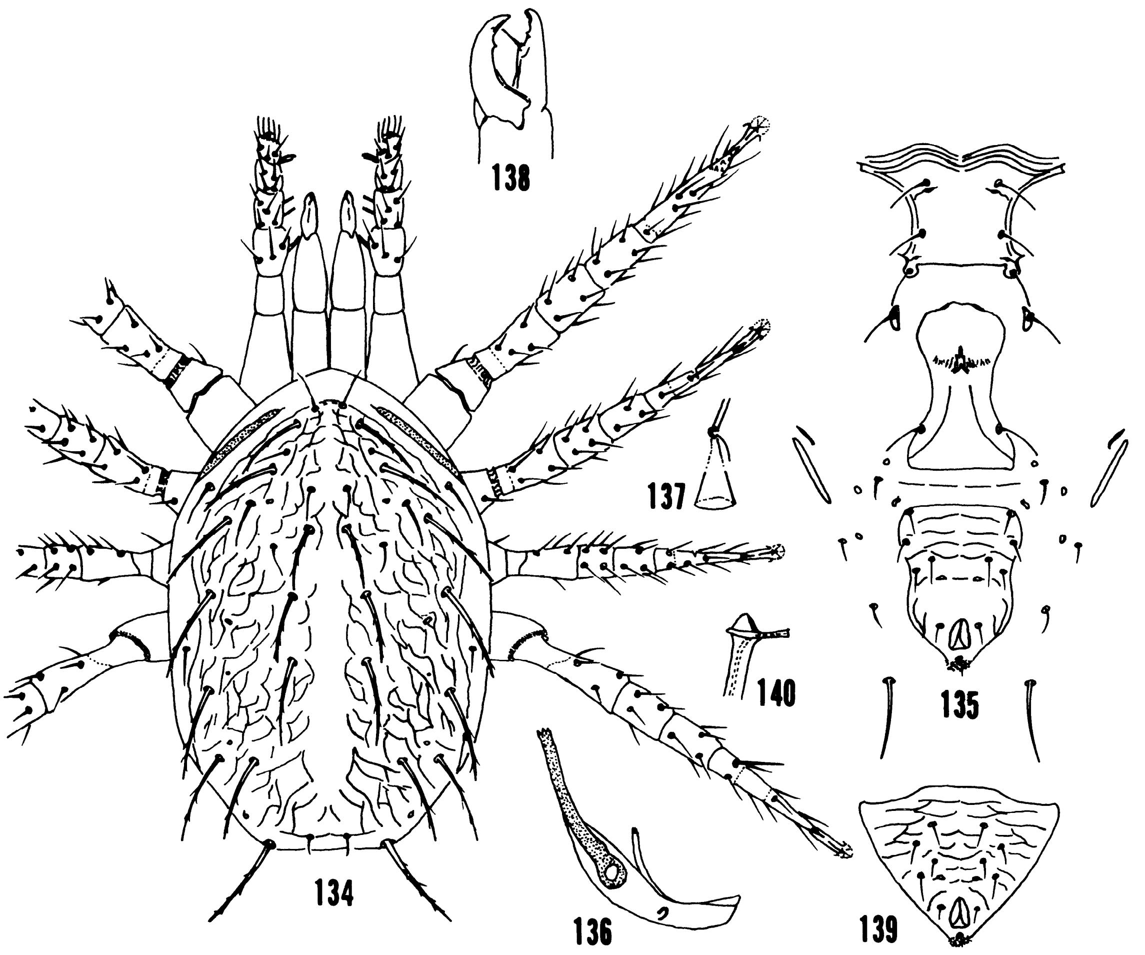
DISCUSSION - This species is known only from the type specimen. Nothing is known about the life history and biology of this species.

Typhlodromus baccettii Lombardini
Fig. 129-133

Typhlodromus baccettii Lombardini, 1960: 19; Ragusa & Swirski, 1979: 215; Moraes et al., 1986: 243; Chant and Yoshida-Shaul, 1987: 1780.

Typhlodromus helenae Schicha and Dosse, 1974: 79. (TYPE: Australia: New South Wales, Biological and Chemical Institute, Rydalmere).

Typhlodromus oligadensis Athias-Henriot, 1978: 697. (TYPE: France: Coppeau, E.N.S.A.-I.N.R.A., Montpellier, France).



Figs. 134-140. *Typhlodromus magdalenae* Pritchard and Baker. 134. Dorsal and leg structure and setation (female). 135. Ventrianal scuta and setation (female). 136. Posterior peritremal and stigmatal development (female). 137. Spermathecal structure (female). 138. Cheliceral structure (female). 139. Ventrianal scuta (male). 140. Spermatodactyl structure (male).

TYPE - Female holotype, Italy: Firenze, ? IX 1960, from *Cupressus sempervirens* in Instituto di Entomologia Agraria, Universita Degli Studi di Palermo, Palermo, Italy.

DIAGNOSIS - *Typhlodromus baccettii* Lombardini has 3 large pores, 5-6 small to medium size pores, scattered muscle marks, and 17 pairs of setae.

FEMALE - Length 310; width at L_5 180. Dorsal scutum reticulated with 3 large pores, 5-6 small to medium pores, scattered muscle marks, and 17 pairs of setae. Measurements of setae: verticals 22-25; D_1 15, D_2 15, D_3 17, D_4 19; clunals 5; L_1 23-27, L_2 18-18, L_3 23, L_4 24, L_5 24-27, L_6 27, L_7 28, L_8 31, L_9 50-53; M_1 15, M_2 28-33; anterior sublaterals 22; posterior sublaterals 19. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum lightly creased with 4 pairs of preanal setae and 2-3 pairs of ventrolateral setae. Peritreme extending anteriorly to L_1. Chelicerae normal in relation to body size, fixed digit with 2-3 denticules, and movable digit with 1 denticule. Leg formula 4123. Macrosetae Sge IV 19-20, Sti IV 22-27, and St IV 37-47. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca short saccular cervix 11-12 with nodular c-shaped atrium.

MALE - Similar to female but smaller. The ventrianal scutum lightly creased with 4 pairs of preanal setae. The spermatodactyl without heel or lateral process and toe slightly enlarged oval. This description is based on specimen collected in Australia and described by Schicha and Dosse (1975) under the name *Typhlodromus helenae* and Lombardini (1960).

DISCUSSION - This description is based on nontype specimens collected by S. Ragusa in Palermo, Italy, 8 II 1977 from *Cupressus orizzontalis*. Chant and Yoshida-Shaul (1987) reported additional collections from Tuscany, Italy and Coppeau, Vaucluse, France. *Typhlodromus helenae* Schicha and Dosse (1974) was collected at Bathurst, New South Wales, Australia from apple leaves. Schicha (1977) described the immature stages of *helenae*.

TYPHLODROMUS (TRIONUS) DENMARK NEW SUBGENUS

Females of this subgenus always have 3 pairs of sternal setae, 4 pairs of preanal setae, none to 1 macroseta, and 1-4 medium pores on the dorsal scutum.

TYPE SPECIES - *Typhlodromus magdalenae* Pritchard and Baker, by present designation.

MAGDALENAE GROUP

T. magdalenae Pritchard and Baker
T. griekwensis Schultz
T. roshanlali Narayanan & Ghai

Key to Females in *Magdalenae* Group

1. Leg IV with 1 macroseta 2
   Leg IV without macroseta ....
   .... *roshanlali* Narayanan & Ghai, p. 33
2. D_3 extends to base of D_4 and most dorsal setae serrate ....
   .... *magdalenae* Pritchard & Baker, p. 32
   D_3 not extending to base of D_4 and dorsal setae not serrate ....
   .... *griekwensis* Schultz, p. 32

Typhlodromus magdalenae Pritchard and Baker
Fig. 134-140

Typhlodromus magdalenae Pritchard and Baker, 1962: 218; Van der Merwe, 1968: 65; Swirski and Ragusa, 1978: 408; Ueckermann and Loots, 1985: 5-7; Moraes et al., 1986: 244; Chant and Yoshida-Shaul, 1987: 1800.

TYPE - Female holotype (No. 2698), Belgian Congo: Liviro, IRSAC, 18 V 1955, E.W. Baker, on tree legume, in U.S.NMNH.

DIAGNOSIS - *Typhlodromus magdalenae* Pritchard and Baker is similar to *Typhlodromus roshanlali* Narayanan and Ghai but differs in having a fundibular spermatheca, a macroseta on leg IV, D_2-D_4 serrate, and L_1, L_3, L_4, L_5, L_6, L_7, L_8, and L_9 serrate as apposed to saccular spermatheca, no macroseta on leg IV, and no setae serrate in *roshanlali*.

FEMALE - Length 350; width at L_5 169. Dorsal scutum reticulated, 4 medium sized pores, and 17 pairs of setae. Measurements of setae: verticals 22; D_1 20, D_2 45, D_3 50, D_4 56-60; clunals 5; L_1 40, L_2 18-22, L_3 31-50, L_4 19-20, L_5 53-56, L_6 58-61, L_7 63-73, L_8 62-65, L_9 57-66; M_1 19-23, M_2 57-59; anterior sublaterals 25; posterior sublaterals 25. Sternal scutum smooth with 2 pairs of pores and 3 pairs of setae. Ventrianal scutum lightly creased with a pair of elliptical pores, 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to L_1. Chelicerae normal in relation to body size, fixed digit with 2 denticules, movable digit with 1 denticule. Leg formula 1423. Macroseta St IV 32-35. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with fundibular cervix 13-19 with membranous walls between c-shaped atrium and inner thickened wall.

MALE - Similar to female but smaller in size. The ventrianal scutum reticulated with a pair of small pores and 4 pairs of preanal setae. The spermatodactyl has heel terminal, lateral process missing, and small and undifferentiated toe.

DISCUSSION - Pritchard and Baker (1962) reported this species on tree legume, grape leaf, cherimoya, *Haronga paniculata*, banana, frangipani, and on *Astrum* sp. from the Belgian Congo and Central Africa. Van der Merwe (1968) reported this mite from *Passiflora* sp. leaves, Tzaneen (Tvl.) and from *Mangifera indica*, Westfalis near Tzaneen (Tvl.). Swirski and Ragusa (1978) reported this mite from Kenya on *Persea americana* leaf. Ueckermann and Loots (1985) reported *Typhlodromus magdalenae* in association with *Amblyseius tamatovensis* Blommers and *Iphiseius degenerans* Berlese. Chant and Yoshida-Shaul (1987) reported this species from Zaire, Ruanda-Urundi, Kenya and South Africa (Transvaal) on the following plants: *Haronga paniculata*, banana, *Acacia cyanaphylla*, frangipani, *Astrum* sp., *Passiflora* sp., *Mangifera indica*, *Trema orientalis*, and *Persea americana*. Nothing is known of its biology. This description is based on the holotype specimen.

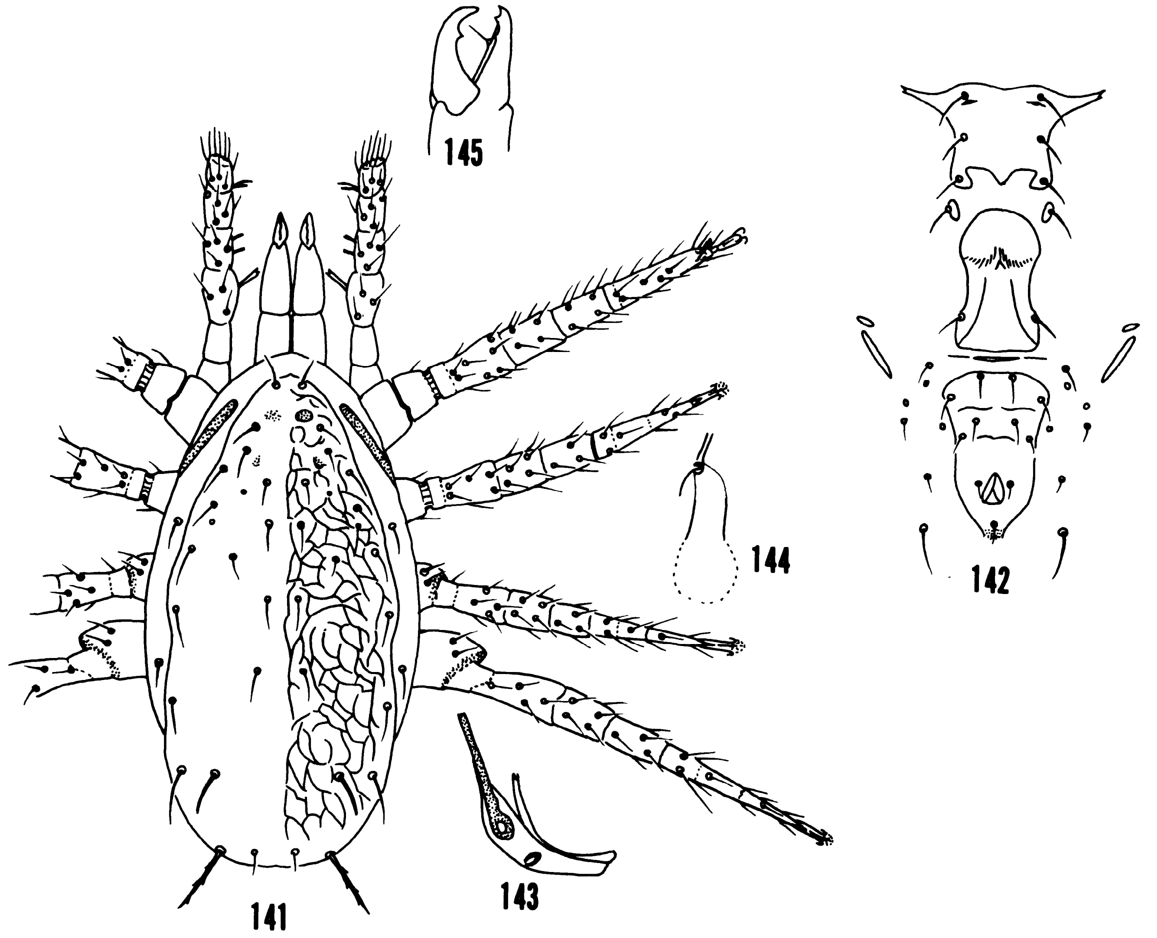
Typhlodromus griekwensis Schultz
Fig. 141-145

Typhlodromus griekwensis Schultz, 1973: 103; Moraes et al., 1986: 244; Chant and Yoshida-Shaul, 1987: 1777.

TYPE - Female holotype, South Africa: Griekwastad, Cape Province, 15 IX 1970, L. Smith, on *Rhus undulata*, in Plant Protection Institute, Department of Agricultural Technical Services Collection.

DIAGNOSIS - *Typhlodromus griekwensis* Schultz is distinct from *Typhlodromus magdalenae* and *Typhlodromus roshanlali* by not having a pair of pores on the ventrianal scutum, L_3, L_6, and L_7 are approximately half as long as they are in *magdalenae* and *roshanlali*.

FEMALE - Length 349; width at L_5 165. Dorsal scutum reticulated with 2 small pores and 17 pairs of setae. Measurements of setae: verticals 13; D_1 16, D_2 17, D_3 20, D_4 22; clunals 8; L_1 20, L_2 15, L_3 18, L_4 22, L_5 27, L_6 28, L_7 32, L_8 36, L_9 44; M_1 17, M_2 33; anterior sublaterals 18; posterior sublaterals 16. Sternal scutum smooth with 1 pair of pores and 3 pairs of



Figs. 141-145. *Typhlodromus griekwensis* Schultz. 141. Dorsal and leg structure and setation (female). 142. Ventrianal scuta and setation (female). 143. Posterior peritremal and stigmatal development (female). 144. Spermathecal structure (female). 145. Cheliceral structure (female).

setae. Ventrianal scutum smooth to lightly creased anteriorly, 4 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to L_1. Chelicerae normal in relation to body size, fixed digit with 1 denticule, movable digit with 2 denticules. Leg formula 4123. Macroseta St IV 31. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with saccular cervix 12 and c-shaped atrium.

MALE - Unknown.

DISCUSSION - This species is known from the holotype and female paratype collected in Prieska, Cape Province, 16 IX 1970, M.K.P. Meyer, on *Lycium braussii*. Chant and Yoshida-Shaul (1987) reported additional collections at Cape Province and Namibia on *Lycium cinereum, Acacia cinereum, Acacia mellifera, Pentzia calcarea, Pentzia quinquefida,* and *Zygophyllum simplex.* Nothing is known about the biology of this species. This description is based on the paratype specimen.

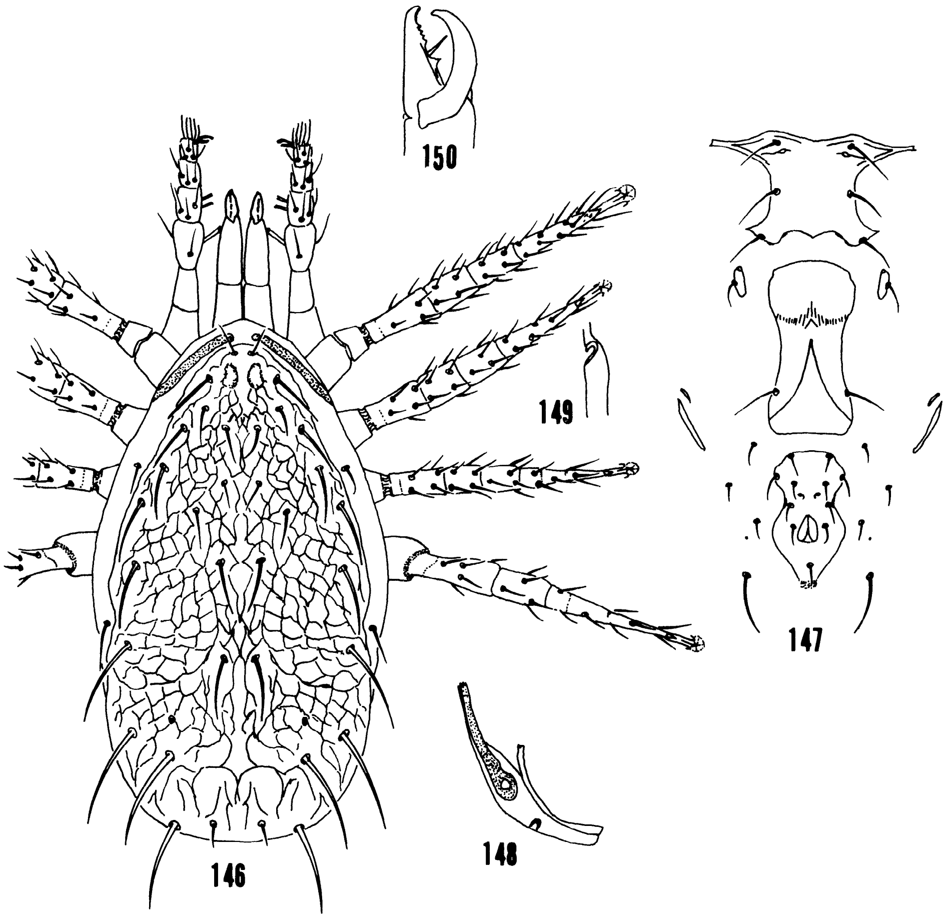
Typhlodromus roshanlali Narayanan and Ghai
Fig. 146-150

Typhlodromus roshanlali Narayanan and Ghai, 1963: 539; Ghai, 1964: 391; Ehara, 1966: 19; Prasad, 1974: 175; Moraes et al., 1986: 248; Chant and Yoshida-Shaul, 1987: 1771.

TYPE - Female holotype, India: New Delhi, I.A.R.I., 24 II 1960, Roshanlal, on mango, in National Pusa Collection, Indian Agricultural Research Institute, New Delhi.

DIAGNOSIS - See *Typhlodromus magdalenae* Narayanan and Ghai.

FEMALE - Length 340; width at L_5 145. Dorsal scutum reticulated with 1 medium size pore and 17 pairs of setae. Measurements of setae: verticals 19-24; D_1 19-24, D_2 20-22, D_3 20-24, D_4 32-36; clunals 6; L_1 16-33, L_2 20-23, L_3 32, L_4 31-33, L_5 35-39, L_6 45-59, L_7 50-58, L_8 42-50, L_9 50-53; M_1 20, M_2 56-62; anterior sublaterals 20; posterior sublaterals 31. Sternal scutum



Figs. 146-150. *Typhlodromus roshanlali* Narayanan and Ghai. 146. Dorsal and leg structure and setation (female). 147. Ventrianal scuta and setation (female). 148. Posterior peritremal and stigmatal development (female). 149. Spermathecal structure (female). 150. Cheliceral structure (female).

smooth with a pair of pores and 3 pairs of setae. Ventrianal scutum smooth with a pair of pores, 4 pairs of preanal setae, and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to verticals. Chelicerae normal in relation to body size, fixed digit with no denticules, movable digit with 5 denticules. Leg formula 4123. No macrosetae on leg IV. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with fundibular cervix 16 and c-shaped atrium.

MALE - Three males were collected with the holotype.

DISCUSSION - This mite was found associated with *Aceria mangiferae* Sayed. Nothing is known about the biology of this species. This description is based on the holotype specimen.

TYPHLODROMUS (OUDEMANUS) DENMARK NEW SUBGENUS

Species in this subgenus have 2 pairs of sternal setae, 3 pairs of preanal setae, 4 large pores on the dorsal scutum, and 1 or 3 macrosetae on leg IV.

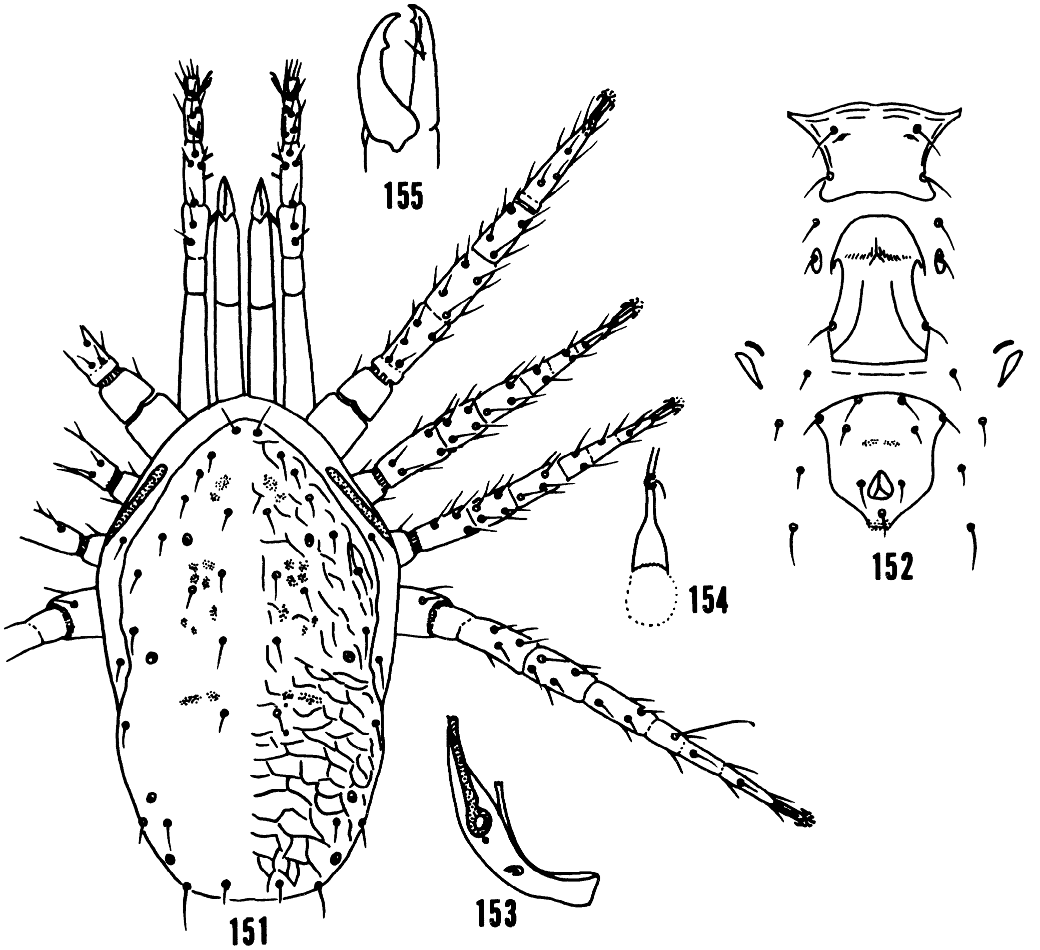
TYPE SPECIES - *Typhlodromus longipalpus* Swirski and Ragusa, by present designation.

LONGIPALPUS GROUP

T. leptodactylus Wainstein
T. longipalpus Swirski and Ragusa

Key to the Females of *Longipalpus* Group

1. Leg IV with 3 macrosetae ....
.... *longipalpus* Swirski and Ragusa, p. 36
Leg IV with 1 macroseta......................................
.... *leptodactylus* Wainstein, p.35



Figs. 151-155. *Typhlodromus leptodactylus* Wainstein. 151. Dorsal and leg structure and setation (female). 152. Ventrianal scuta and setation (female). 153. Posterior peritremal and stigmatal development (female). 154. Spermathecal structure (female). 155. Cheliceral structure (female).

Typhlodromus leptodactylus Wainstein
Fig. 151-155

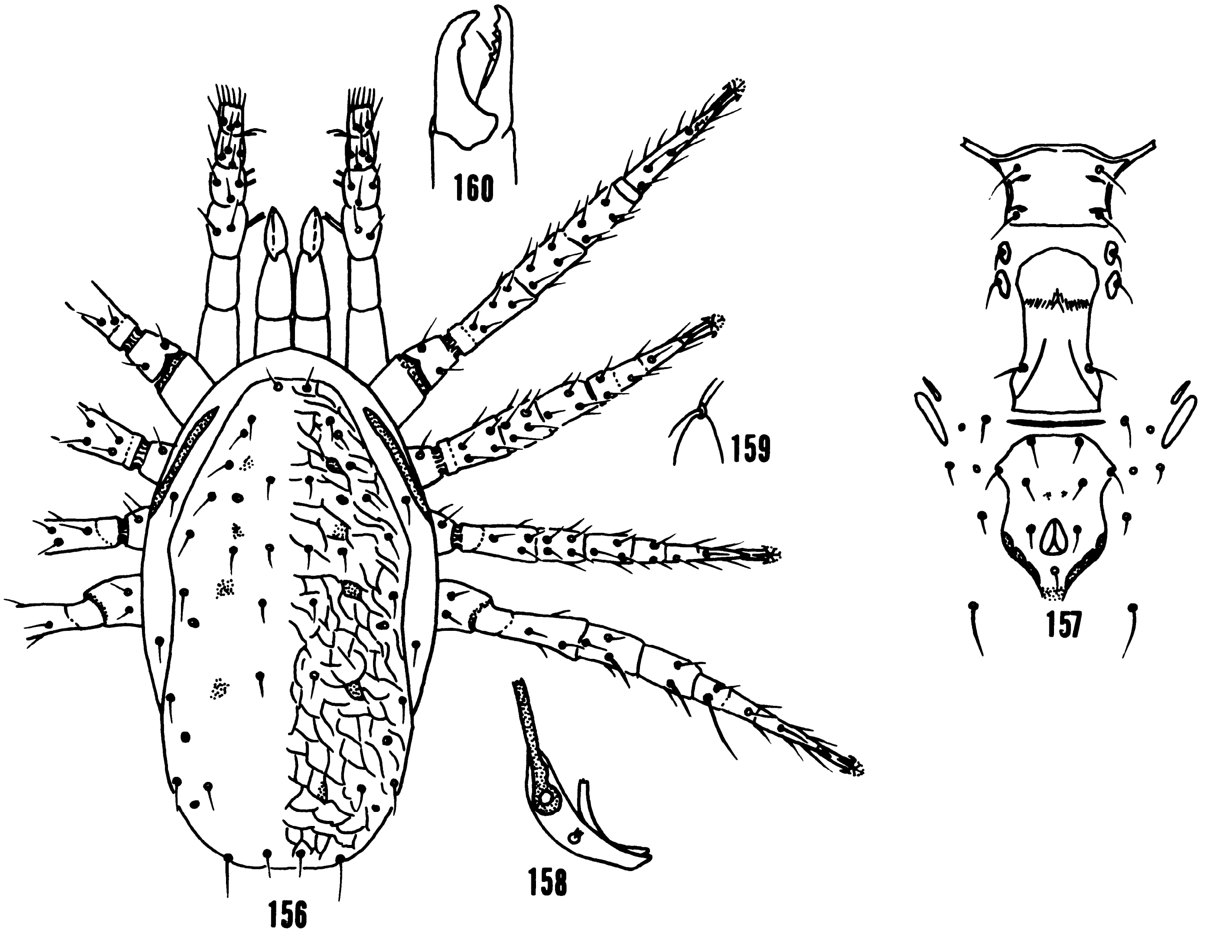
Typhlodromus leptodactylus Wainstein, 1961: 153; Hirshmann, 1962: 16; Ehara, 1966: 19; Arutunjan, 1969: 178; Arutunjan, 1970: 20; Arutunjan, 1971: 45;Livshitz & Kuznetsov, 1972: 16; Moraes et al., 1986: 244; Chant and Yoshida-Shaul, 1987: 1773.

Wainsteinus leptodactylus (Wainstein), Arutunjan, 1969: 178.

TYPE - Female holotype, U.S.S.R.: Pantisharskae Canyon, Eastern Georgia, G.F. Rekk, on *Juniperus* sp., In Institute of Zoology, Academy of Sciences of the Ukranian S.S.R., Kiev.

DIAGNOSIS - *Typhlodromus leptodactylus* is similar to *Typhlodromus longipalpus* Swirski and Ragusa but differs in having S_1 and S_2 11, peritreme extending anteriorly to L_2, only 1 macroseta on leg IV and tubular-fundibular spermatheca with the cervix 16, and greatly extended palps as apposed to S_1 and S_2 18, peritreme extending anteriorly to L_1, 3 macrosetae on leg IV, a pocular spermatheca with cervix 7, and palps not unusually extended in *longipalpus*.

FEMALE - Length 338; width at L_5 170. Dorsal scutum reticulated, posteriorly with 4 large pores, scattered muscle marks, and 17 pairs of setae. Measurements of setae: verticals 13; D_1 11, D_2 9, D_3 11, D_4 12; clunals 4; L_3 13, L_4 14, L_5 15, L_6 16, L_7 17, L_8 20, L_9 25; M_1 11, M_2 17; anterior sublaterals 11; posterior sublaterals 11. Sternal scutum smooth with 1 pair of pores and 2 pairs of setae. Ventrianal scutum smooth with 3 pairs of preanal setae and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to L_2. Chelicerae normal in relation to body size, fixed digit with 1 denticule, movable digit with 1 denticule. Leg formula 4123. Macroseta St IV 50. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with tubular-fundibular cervix 16 and c-shaped atrium.



Figs. 156-160. *Typhlodromus longipalpus* Swirski and Ragusa. 156. Dorsal and leg structure and setation (female). 157. Ventrianal scuta and setation (female). 158. Posterior peritremal and stigmatal development (female). 159. Spermathecal structure (female). 160. Cheliceral structure (female).

MALE - Unknown.

DISCUSSION - In addition to the type collection, it has been collected in Armenia on *Juniperus* sp., (Arutunjan, 1969: 180, 1970: 20, 1971: 42); Arutunjan (1969) placed *leptodactylus* in the monotypic genus *Wainsteinus* based on the elongate palps; in Azerbaijan on *Cupressus* sp., false arborvitae, *Pinus* sp. (Abbasova, 1980); in Crimea on *Cupressus* sp., arborvitae, *Juniperus* sp., *Libocedrus tetagona, Sequoia gigantea* (Livshitz and Kuznetsov, 1972); in Georgia on *Juniperus* sp. (Arutunjan, 1969). Abbasova (1980); Chant and Yoshida-Shaul (1987) reported *T. longipalpus* to be a junior synonym of *T. leptodactylus*. I found the two species distinct (See diagnosis). Nothing is known about the biology of this species. This description is based on holotype specimen.

Typhlodromus longipalpus Swirski and Ragusa
Fig. 156-160

Typhlodromus longipalpus Swirski and Ragusa, 1976: 115; Abbasova, 1980: 831; Moraes, et al., 1986: 244; Chant and Yoshida-Shaul, 1987: 1773.

TYPE - Female holotype, Greece: Athens (Pnyx), 1 VIII 1972, E. Swirski and S. Ragusa, on *Cupressus sempervirens,* in Division of Entomology, ARO, Bet Dagan, Israel.

DIAGNOSIS - See *Typhlodromus leptodactylus* Wainstein.

FEMALE - Length 332-344; width at L_5 172. Dorsal scutum reticulated with 4 large pores, scattered muscle marks anteriorly, and 17 pairs of setae. Measurements of setae: verticals 15-17; D_1 12-13, D_2 12-13, D_3 12-15, D_4 12-15; clunals 4; L_1 15-17, L_2 12-13, L_3 13, L_4 12-15, L_5 17-18, L_6 17-18, L_7 17, L_8 17-18, L_9 23-27; M_1 12-13, M_2 17-18; anterior sublaterals 17-18; posterior sublaterals 17-18. Sternal scutum smooth with 2 pairs of pores and 2 pairs of setae. Ventrianal scutum smooth with 3 pairs of preanal setae, and 3 pairs of ventrolateral setae. Peritreme extending anteriorly to L_1. Chelicerae normal in relation to body size, fixed digit with 4 denticules, and movable digit with 1 denticule. Leg formula 4123. Macrosetae Sge IV 22, Sti IV 27-28, St IV 43-45. Genu II 2-2-2/0-1; genu III 1-2/1-2/0-1. Spermatheca with pocular cervix 7 and nodular atrium.

MALE - Unknown.

DISCUSSION - This species is known from the type collection and specimens that have been taken on *Cupressus sempervirens* and *Pinus* sp. Nothing is known of the biology of this species. This species has been reported by Abbasova (1980) and Chant and Yoshida-Shaul (1987) as being a junior synonym of *T. leptodactylus* Wainstein. I disagree based on the differences in number of macrosetae on leg IV and shape of spermatodactyl (see diagnosis for differences). This description is based on holotype specimen.

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